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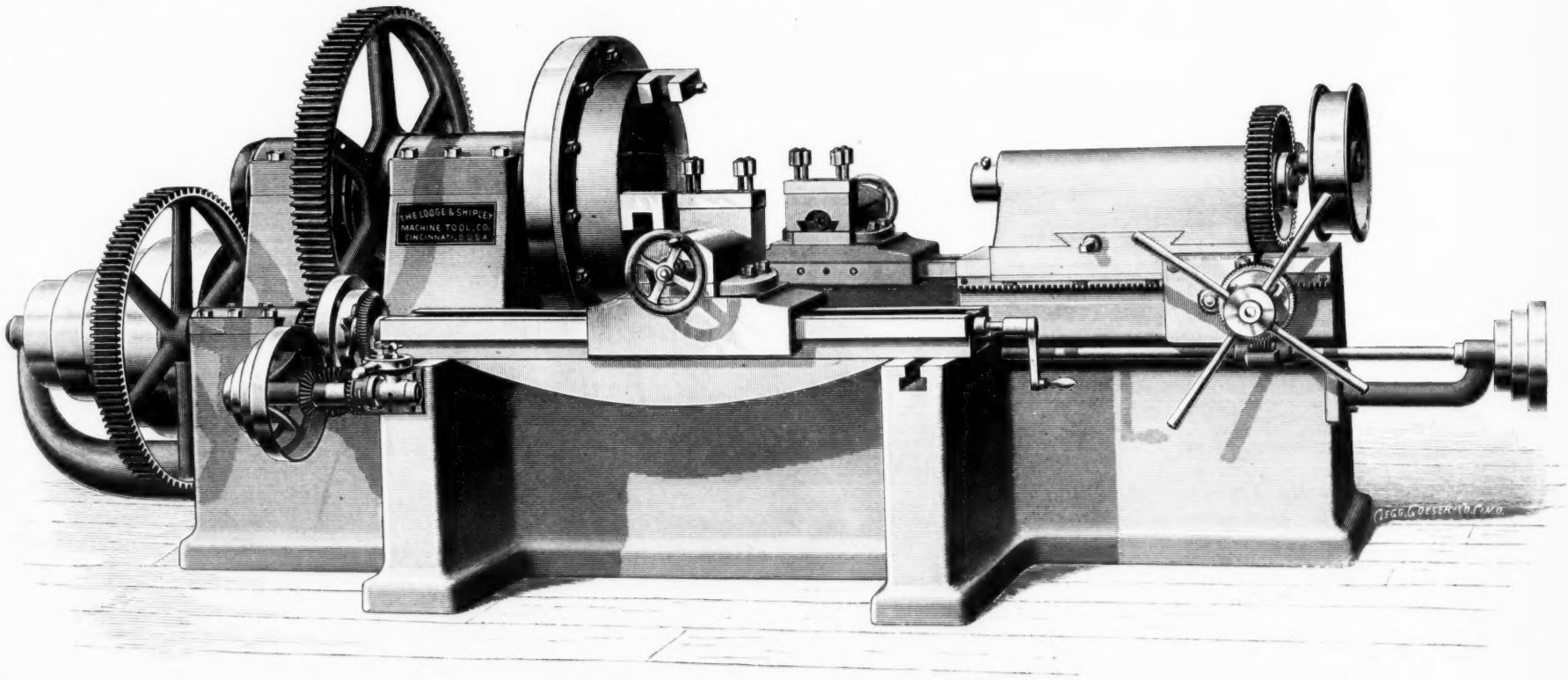
Crank Disk Turning and Boring Machine.

We illustrate on this page a crank disk turning and boring machine; so called from its special adaptability to that work, though it is, of course, suitable for a wide range of work, involving both turning and boring upon the same piece. The machine is so arranged that a crank disk for an engine may be chucked and turned, bored for the shaft and then bored for the pin without removing it.

The bed, which includes the head and foot-stocks together with the wings, is all one casting. The spindle is 10 inches in diameter, 36 inches long, and has a 4¾ inch hole passing entirely through it. The thread upon the spindle is 14¾ inches diameter and is chased two threads to the inch, so that a face-plate or chuck may be easily fitted. The spindle is scraped into the head-stock, which is provided with ample lubricating facilities, so that there is no need of any cutting.

The cone pulley is of six steps, varying from 26 inches to 13 inches for 4¾ inch belt. The ratio of revolutions of the cone pulley to live spindle is 60 to 1. The distance between head and foot stock is 48 inches and a piece 40 inches width by 60 inches diameter may be turned. The rails are of the box form of section and are designed with special reference to avoidance of vibration or tremor. They are movable to and from the center so that the machine will turn down to 12 inches diameter; they also swivel so that work may be accurately turned or bored taper. Power cross and angle feeds are supplied to the front tool post. A cross rail, for turning small diameters, may be supplied as an extra. The foot-stock or boring head is designed to be massive enough to bore heavy cuts accurately and an especially desirable feature is its set-over movement of 12 inches, enabling the machine to bore cranks up to a corresponding throw.

The gearing shown gives a very powerful and steady cut to the boring bar. Boring head has power length feed, also pilot wheel for quick hand feed. The machine complete weighs about ten tons, and is built by the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio.



CRANK DISK TURNING AND BORING MACHINE.

Throttling vs. Automatic Cut-off—Balancing Pulleys and Fly-wheels.

BY W. H. BOOTH.

There is an old saying that half the truth is worse than a whole lie. Something of this sort seems applicable to the ventilation recently of the fact that very excellent results have been obtained by certain English engine makers with an engine that is governed by throttling.

The fact is not disputed, but there is a tendency to present the fact without its outer shell, and it is by no means always good practice to get at the kernel of things to the entire neglect of the outer shell. The actual facts as to the Willans high-speed throttling engines are not to the effect that cut off engines may be abolished for throttling engines, but that under certain fixed conditions the now old fashioned throttle may be employed without loss and to the gain in cheapness and simplicity of construction.

But what are the conditions? We all know that every engine has a certain rate of doing work at which it is found to give its best and most economical results, and that for some little distance on either side of this datum line of maximum efficiency, any change in load does not produce a serious drop in the economical efficiency. It follows that when an engine is designed to do a certain duty with a given fixed cut-off, and with steam throttled down to, say, ten pounds below boiler pressure, we may open or close the throttle to give, say, 7 pounds or 12 pounds below boiler pressure with but little effect in economy.

This is what practically is done with the Willans engine. There will be a half dozen such engines in one room, all grinding out electricity into one main, and at about 8 o'clock on a winter evening they will all be working at their designed, most economical rate. A seventh engine is helping them and is being run under the throttle, and at something less than its most economical loading. Let us suppose that this number seven is losing 7 per cent. in efficiency by being so run. Then this 7 per cent. on, say, 150 horse-power is spread over not only this 150 horse-power of No. 7 engine, but over the 200 horse-power of all the other six engines. The loss on the whole horse-power in the set is, after all, only $\frac{150}{1850}$ of 7 per cent., or only .63 per cent. upon the whole power. As the load becomes less the No. 7 engine can be stopped entirely, and for some time the remaining six engines work at or within a little of their maximum efficiency, and this goes on until it becomes necessary to throttle number 6, and run five engines only at full power.

It is not altogether that throttling has been rehabilitated so much as that it has been found good to run engines at a constant and unvarying load, and this has long been known to be economical.

With high pressures and multiple cylinders throttling has less wasteful effects than in low pressures and single cylinders. Indeed, the rough rule might be laid down that in proportion as the indicator cards from an engine lose that elegant appearance that is associated in our mind with the card from a good cut-off single cylinder engine, so will the harm from throttling lose its sting. Nevertheless, all this does not make throttling good in principle, though we may recognize frequent examples of expensive cut-off gears that have been out of place.

Where there is no cut-off gear it is better to throttle down high pressure steam than to work from a low pressure with full open valve. I recollect a case of this where a steam user had a good boiler and a weak engine. Having a boiler rated at 80 pounds he carried this pressure, but never let the piston feel more than 40 pounds. One day he became alive to the folly of this and determined no longer to unnecessarily strain his boiler by a pressure he could not use, and he forthwith reduced the pressure. The result was that the engine valves being still the same in setting his engine would not do the work it had previously done. An engineer explained to him that though he still had the same initial pressure he no longer had the benefit of superheated steam, whereas formerly, by the use of the throttle he caused the steam to become dry, reduced the cylinder condensation, and was working altogether on a better system, as the fireman very quickly discovered, for more fuel was burned.

The pressure was raised again to the old figure; there was no folly in it after all, but it would have been better to have had an engine strong enough to utilize the high pressure than a throttle valve to cause superheat.

Given a perfectly steady load and neither a cut off nor a throttle is needed. It is perfectly obvious that with an effort being made to secure a uniform load to an engine the application of a cut off gear would be superfluous.

It has often appeared to me that considering the uniform load of a large factory engine a great deal too much is often spent upon valve gears which, within the small range over which they have to pick up their results, do not get a chance to save enough of fuel to pay for the interest on the investment and the power necessary to turn the extra eccentrics, etc. Some of the Oldham Cotton Mills fairly bristle with the unnecessary complication of parts required to drive cut-off valves and appliances.

In boring and turning pulleys some people chuck them by the inside of the rim, others by the outside. They who do the latter are more apt to get an unbalanced pulley than are they who set by the inside of the rim, for, when chucked true by the inside the final turned rim is more likely to be of even thickness all round and to require less balance and so be in less danger of bursting when running. With a pulley thus chucked any inequality is apt to be confined to the boss where it has the minimum effect, and I feel sure that "Quirk" has put his finger on the cause of many bursts of wheels. It would frequently be better (though perhaps more costly) to put into the light side of a pulley a long strip of balancing metal riveted over a considerable arc of the rim than to put in the thick bit of plate that is attached by two rivets on the spot where a lump of clay or putty has been found to give a mere standing balance. Are pulley balancers sufficiently careful to find whether the weight they add is one that gives not merely static balance but also a balance laterally when running? If one edge of a rim be too heavy the result when in motion will be a lateral stress on the arms, and yet such a pulley might rest impartially at any position when on the balancing rails. Usually this lateral effect would be small and act at a short leverage in most pulleys, but this is no reason for patching on balance plates needlessly out of the middle of the rim.

Plate Planing Machine.

We illustrate herewith a machine for planing the edges of boilers and plates. In this machine the usual beam with screws or jacks for holding the plate is dispensed with, the intention being to do the planing after the rivet holes have been made, and make use of them to pass bolts through the plate, and through the slot shown in the rail at the rear of the machine, thus clamping the plate in place; as many bolts being used as may seem necessary.

It consists of a heavy cast iron bed with sliding reversible rest, operated by a heavy steel screw which runs the entire length through a heavy brass nut fastened to the rest. The screw is operated by gearing at the end, and tight and loose pulleys with straight and cross belts about 4 inches wide. There are two tools in the tool post which cut both ways, at the rate of 16 to 18 feet per minute. A shifting bar runs the entire length of machine, always in front of the operator, so that the machine can be stopped or reversed without him leaving his position. The shifting or reversing bar is provided with adjustable knockers, so that the machine will stop or reverse itself at any desired length or width of plate.

The machine will plane $\frac{1}{4}$-inch to $\frac{3}{8}$-inch plates up to 16 feet long, and by re setting, up to any desired length, re setting usually requiring about five minutes time where a crane or chain hoist is used. Machines are made to plane up to 30 feet in length when required. The builders are The Schuylkill Foundry and Machine Works, Conshohocken, Pa.

Twenty-four-inch Band Saw.

We illustrate herewith a new 24 inch power band saw designed for pattern shops, machine shops, or for any light wood working where it is not necessary to have a large or heavy machine.

It is self contained, having countershaft of suitable proportions attached to it; requiring less room to set it up and making its removal from one part of the shop to another, or from one position to another, a matter of trifling importance.

The table is made of kiln-dried hard wood 2 feet by 2 feet, and is arranged to tilt for sawing a bevel. It has an extra table on side to prevent chips or pieces falling onto pulleys or belt. The saw pulleys are covered with endless pure rubber bands strengthened with canvas.

The shafts are all of steel and run in long boxes lined with best genuine babbitt, and then bored to exact size with boring bar. The machine can be furnished without countershaft if desired. Space occupied on the floor is 2 feet by 4½ feet; weight, 340 pounds. It is made by J. M. Marston & Co., 226 Ruggles street, Boston, Mass.

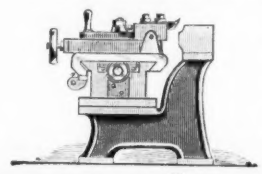
Restoration of Purdue Laboratory.

Our readers will be glad to know that the usefulness of Purdue University will not be permanently lessened, but in fact rather increased as a result, of the fire which destroyed the new Engineering Laboratory, January 23d. The director, Prof. F. M. Goss, who is known to our readers, sends us a statement of what has been and is to be done, from which we quote as follows:

. . . The three months which have passed since the fire, have given time for shaping financial matters, for clearing away debris, for letting contracts, and for beginning the actual work of reconstruction, so that now definite assurances concerning the future may be given. From the detailed statement which follows, it will appear that upon the opening of the next school year, the facilities for laboratory work will be better and more extensive than ever before.

The portion of the building which contained the foundry and the wood-working shop and which was damaged in the fire has been repaired, and all machines and tools originally contained therein have been replaced and are now in use by students. A new and larger cupola furnace has been added to the equipment of the foundry.

The machine shop equipment lost in the fire has already been fully replaced by new and improved machine tools which are now in use by students in temporary quarters. The forge room appliances are all in the process of reconstruction and the whole outfit will be put in place as soon as the building is ready to receive it. . . .



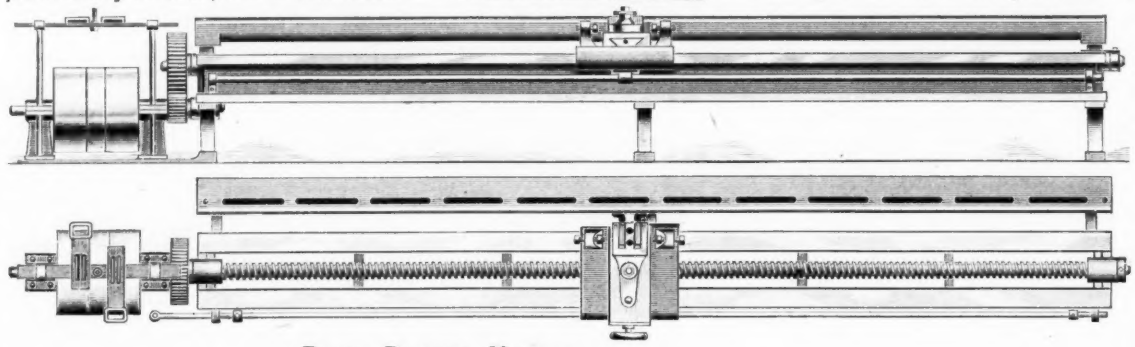


PLATE PLANING MACHINE.

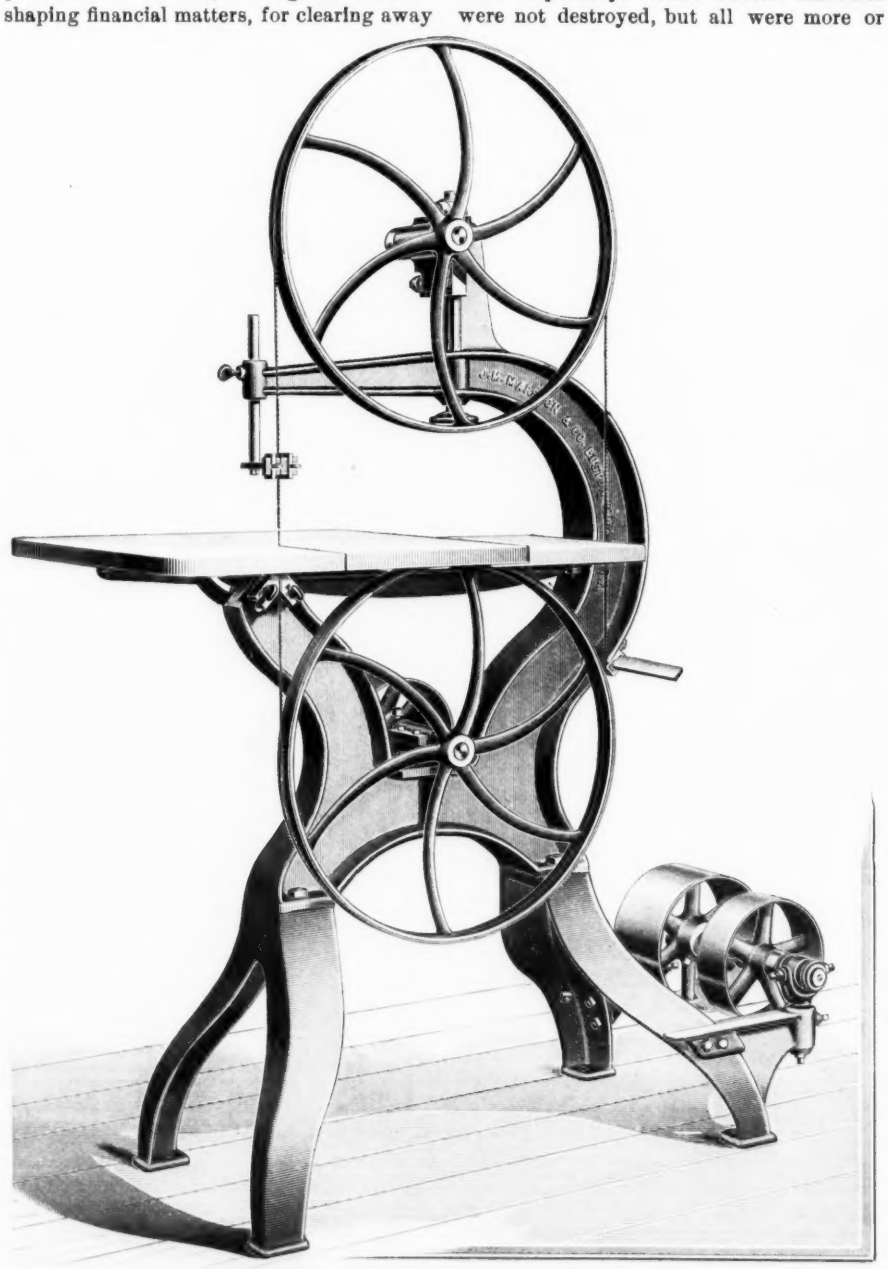
The engineering laboratory contained a large variety of machines, some of which were very heavy. These heavier machines were not destroyed, but all were more or less damaged. The triple-expansion engine, the Westinghouse engine, the boilers, and some of the heavier hydraulic apparatus, are being constructed upon the ground. The locomotive "Schenectady" is to go through the shops of the Pennsylvania Railroad Company at Indianapolis. The smaller steam engines, the gas engines, the pumps, the testing machines, and other light apparatus have been shipped to their respective makers, who have been directed to make them as good as new, or to supply new ones in their places. Small instruments of observation have been purchased, or contracts have been made for them. It can safely be said that these arrangements will result in an equipment for the engineering laboratory which in all respects will be equal, and in some particulars superior to that which it contained before the fire.

. . . The locomotive plant will be removed from the general laboratory to a new building especially designed to receive it. The new plant will be larger and much more complete than the original. Its parts will be made adjustable to receive any locomotive whatsoever, and in order that the whole may be available for testing the performance of locomotives from any part of the country, the building will be connected by a track with the Lake Erie & Western Railroad. The three years' experience with the original apparatus has been made the basis of a careful revision of the details of the locomotive plant. A new traction dynamometer, made up of the weighing portion of an Emery testing machine of 30,000 pounds capacity, has been specially designed, and is now under process of construction, by Messrs. Wm. Sellers & Co. The possession of this fine piece of apparatus will insure great accuracy in the determination of drawbar stresses, which is one of the important elements in the performance of a locomotive. Much other new and delicate apparatus will be connected with the plant.

The steam engineering equipment of the general laboratory will be increased by the addition of the two engines of a Vauclain compound locomotive, arranged to be mounted as a stationary engine upon a foundation, and to be run with steam, under the load of a friction brake. The exhaust will be piped to a surface condenser which will serve to give the steam consumption of the engines, and provision will be made for the attachment of all other apparatus usually employed in testing steam engines. This important piece of apparatus is supplied through the generosity of the Baldwin Locomotive Works. There will also be added, for steam engineering, several typical experimental engines of from 10 to 35 horse-power, each connected with a condenser for determining steam consumption. The list will include a Straight Line engine, a Buckeye engine, and a Laval steam turbine; also a Kimble combined engine and boiler.

For strength of materials there has been purchased the magnificent, 300,000 pound, upright Riehle testing machine exhibited at the World's Fair, and at that time the largest upright machine in the world. This machine will accommodate specimens up to ten feet in length, either for tension or compression. . .

In their efforts to re-establish the laboratory, the trustees gratefully acknowledge the hearty co-operation extended to them by manufacturers of apparatus and machinery. All have been more than liberal in their discounts, and many have made repairs, or have exchanged old for new without cost to the university. It may be added that a considerable amount of the apparatus mentioned above has been loaned to the university for its use until such time as the university shall be able to pay for it.



TWENTY-FOUR-INCH BAND SAW.

From a report to the Board of Trade it appears that the number of persons killed and injured during the past year on British railways was: Passengers—from accidents to trains, rolling stock, permanent way, etc., killed 17, injured 484; by accidents from other causes, killed 89, injured 737; servants of companies or contractors, from accidents to trains, rolling stock, permanent way, etc., killed 10, injured 73; by accidents

from other causes, killed 450, injured 2,558; persons passing over railways at level crossings, killed 55, injured 30, trespassers (including suicides), killed 360, injured 135; other persons not coming in above classification, killed 30, injured 92; total killed, 1,011, injured 4,109; showing a decrease on the totals of the year 1892 of killed 119, injured 376.

A New Turret Drill Press.

It will be remembered that about two years ago we illustrated a turret drill press built by A. D. Quint, of Hartford, Conn. It will be remembered that the spindles in this machine were driven by friction gears which were brought into and out of contact at the proper times by reason of the eccentricity of the turret with respect to the shaft upon which the driving friction gears were placed.

The machine which we now illustrate, while it is much the same in principle, is adapted to a heavier range of work, and its spindles are driven positively by bevel gearing, though the arrangement is such that the change from one spindle to another is made with all the facility, and, in fact, in the same manner as it is made in the first-named machine. The construction will be understood from the following description, with the aid of our reproduction of a working drawing:

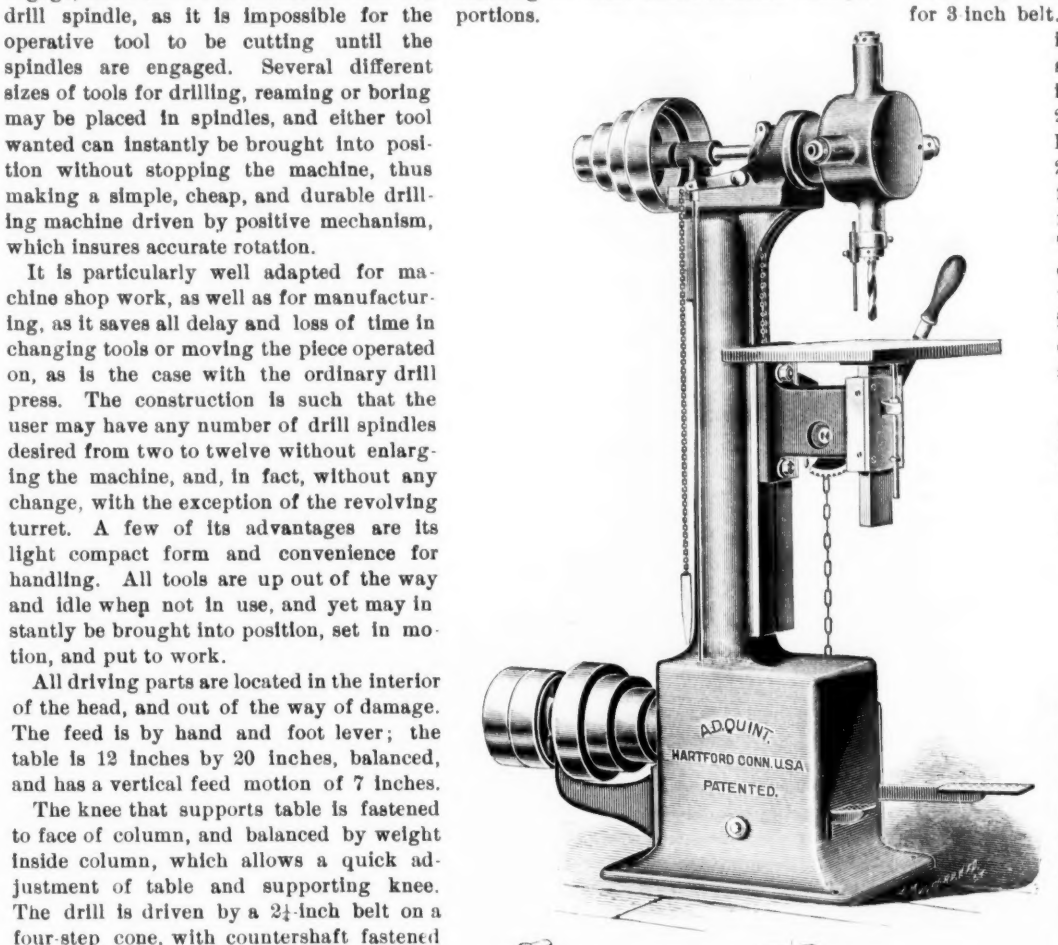
On the column is secured the frame, with a circular hub or trunnion projecting forward, and on this trunnion is mounted the turret head with any number, from two to twelve (cut shows four) of hubs or bearings, which support and guide the drill spindles. Through the frame passes the driving shaft, on the end of which, inside of turret, is fastened a bevel gear in mesh with bevel gear loosely splined by means of feather key to vertical driving spindle that runs continuously in its bearing inside the turret. On the lower end of driving spindle is a clutch that engages when in operation with a corresponding clutch on the inner end of drill spindle which is in use.

Pivoted on the front of gear case in the interior of turret head, is a bell crank lever, one end of which is forked and loosely connected to the driving spindle; the other end of this lever is fastened to the locking bolt that locks the turret head when in position. Connected to the locking bolt is a rod that is fastened to the foot treadle, shown on left-hand side of base; when the foot lever is pressed downward, it causes the locking bolt to move outward and at the same time the driving spindle moves upward and is disengaged from drill spindle before the locking bolt leaves its socket, thus making it impossible for the turret head to be moved while the spindles are engaged. When the turret head is revolved to the tools wanted, the locking bolt will, by means of a spring attached to treadle rod in base, automatically drop into its socket, locking the head in position; at the same time driving spindle moves downward and engages the drill spindle, thus making a positive connection between the driving mechanism and the tool that is in position for work, all other tools remaining idle. It is immaterial whether the driving mechanism is revolving at a high speed or idle, for when the spindles engage, there can be little resistance on the drill spindle, as it is impossible for the operative tool to be cutting until the spindles are engaged. Several different sizes of tools for drilling, reaming or boring may be placed in spindles, and either tool wanted can instantly be brought into position without stopping the machine, thus making a simple, cheap, and durable drilling machine driven by positive mechanism, which insures accurate rotation.

It is particularly well adapted for machine shop work, as well as for manufacturing, as it saves all delay and loss of time in changing tools or moving the piece operated on, as is the case with the ordinary drill press. The construction is such that the user may have any number of drill spindles desired from two to twelve without enlarging the machine, and, in fact, without any change, with the exception of the revolving turret. A few of its advantages are its light compact form and convenience for handling. All tools are up out of the way and idle when not in use, and yet may instantly be brought into position, set in motion, and put to work.

All driving parts are located in the interior of the head, and out of the way of damage. The feed is by hand and foot lever; the table is 12 inches by 20 inches, balanced, and has a vertical feed motion of 7 inches.

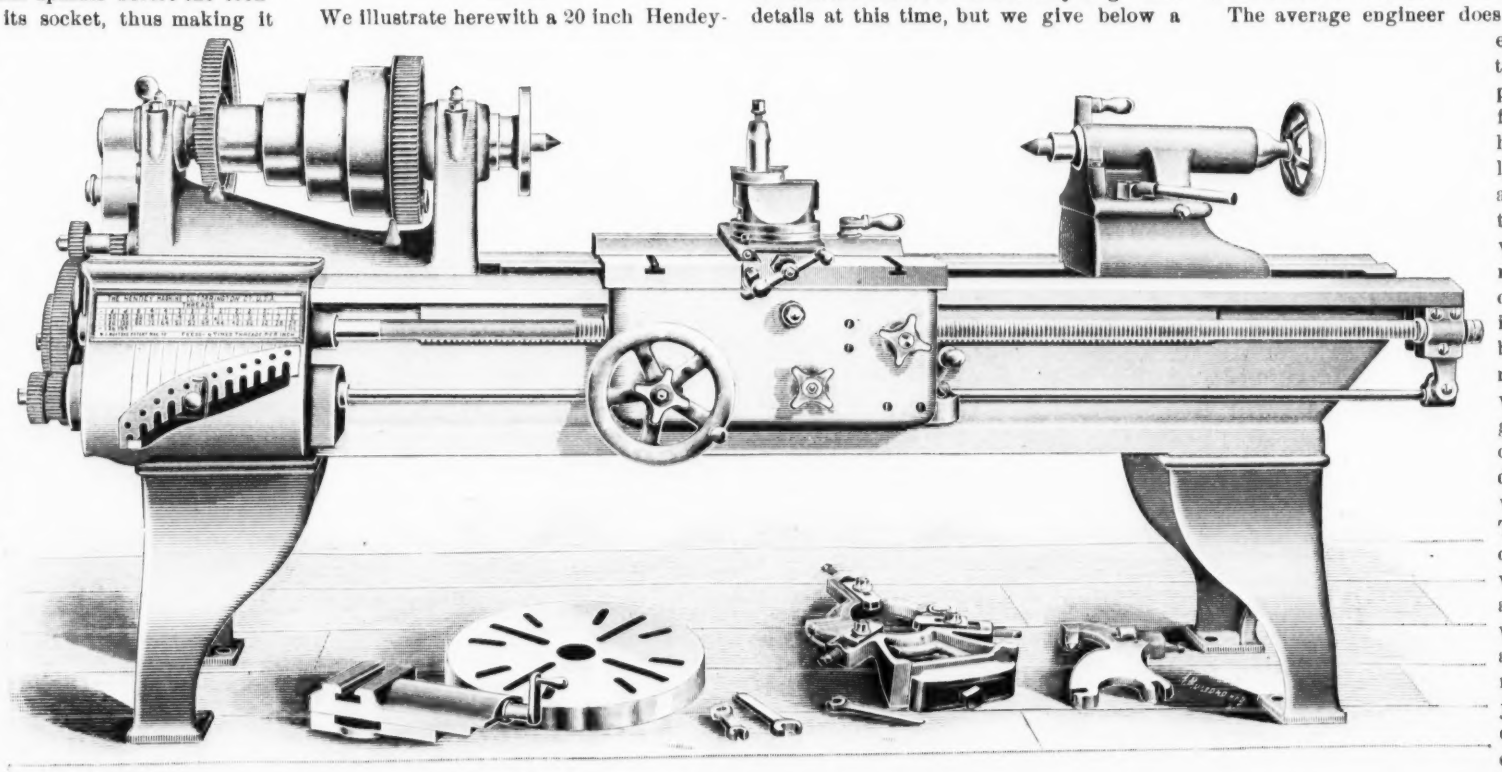
The knee that supports table is fastened to face of column, and balanced by weight inside column, which allows a quick adjustment of table and supporting knee. The drill is driven by a 2¼-inch belt on a four-step cone, with countershaft fastened to base of machine. The drill spindles are of steel, hardened and ground, and are reamed for the No. 2 Morse taper.



NEW TURRET DRILL PRESS.

Twenty-inch Hendey-Norton Lathe.

We illustrate herewith a 20 inch Hendey-Norton lathe with 8 foot bed. This form of lathe has been fully illustrated and described in our columns, the engravings being made, however, from a smaller size lathe differing in some minor features and proportions.



TWENTY-INCH HENDEY-NORTON LATHE.

With the present lathe there is the same facilities for changing from one pitch of screw-cutting to another or the rate of feed without change of gears or belt, and without stopping the machine. Our former illustration makes it unnecessary to go into details at this time, but we give below a few dimensions and figures pertaining to the 20-inch machine.

The proportion of gearing in the head is 12 to 1; cone pulley steps are 4¼ inches, 7 inches, 9¼ inches and 11½ inches diameter for 3 inch belt. Hole through spindle 1½ inches; front bearing of spindle 3 inches diameter, 5 inches long; back bearing 2½ inches diameter, 3¾ inches long. Diameter of tail spindle 2¼ inches. Lathe cuts screws from 1½ to 80 per inch, and feeds from 7½ to 400 per inch. Take 50 inches between centers with 8 foot bed and weighs 3,400 pounds. There is a compound rest, power cross-feed and also taper attachment if desired.

It is made with any length of bed up to 20 feet by The Hendey Machine Company, Torrington, Conn.

High and Low-water Alarms—An Explanation.

BY W. H. WAKEMAN.

At the present time there is much being said in some quarters concerning the use of water columns for steam boilers, which have high and low-water alarms attached. Engineers frequently object to having them put on their boilers, and when this fact is made known to the owners of steam plants and others, they look very wise and put on a knowing smile, which gives the idea that they understand the case fully, and that it is perfectly natural for an engineer to object to the use of something that will act as a tell tale and inform every one in the vicinity when the water is low in his boiler.

I wish to offer an objection to this view of the case, for no greater calamity can befall a careful engineer than through some oversight or unforeseen circumstance to have the water get low in his boiler and to have the sheets burned in consequence. The stigma of such an accident will follow a man for many years. Anything that will promptly and certainly warn him of the approach of such a danger is considered as a friend and not as an enemy.

The average engineer does object, however, to anything that will prevent him from filling his boiler nearly full of water at certain times. In a very large majority of cases the water is lower in boilers in the morning than when the engineer left it on shutting down the previous night. To meet this condition he wishes to leave a plenty of water at night, at times even running his injector after the engine is shut down, but there is the high-water alarm standing like a lion in the path, and preventing him from filling it up. If there is no watchman employed on the place, he

must either come around about midnight and pump in more water, or else shut off the high-water alarm when he stops the engine and put in as much water as he desires. He dislikes to do the latter, and it is manifestly unjust to ask him to do the former. Now, I do not believe that any boiler was ever ruined by having too much water in it, and while it may be that some damage is done to engines in this way in rare cases, still it is very seldom the case, and is practically out of the question.

A certain agent was visiting different manufacturing concerns, trying to sell them these water columns with high and low-water alarms, and on going into one office and making his business known, he was told that they had a careful engineer who attended to all such matters, and therefore they did not need anything of the kind. The agent challenged the steam user to go down to the boiler room at once and see where the water level was in the boilers. It was accepted, and when they arrived there the agent declared that there was too much water in the boilers, and pointed out the fact that if his appliance was in use there, such a thing would never happen. These statements were accepted by the steam user, and the appliances were purchased.

There are two points here which I wish to call attention to, for this agent was most certainly an interested party, and therefore his opinions should be received with some allowance on this account; and, furthermore, it is still an open question among engineers whether there is any loss of efficiency in carrying more water in a boiler than is actually necessary to cover the tubes, or not. If a boiler is pumped nearly full of water, and when the safety valve is lifted only dry steam issues from it, it is good evidence that no water is being carried over, and when such is the case if there is any error in carrying a surplus of water it is an error on the safe side. It is true that it costs more to fire up a boiler which is nearly full of water than it does when there is just enough to cover the tubes, but after steam is once raised, it may not cost any more to keep it up in one case than in the other. On general principles, I believe that an intelligent engineer understands his plant fully as well as an agent who never saw it before.

At a certain plant where there are two boilers fitted with high and low-water alarms, if one of the fires is in better condition than the other so that the setting is heated to a higher temperature at the time that the fires are banked, water will be evaporated in the hottest boiler and be carried over into the other, causing the high-water alarm to sound during the night, although there is still an abundance of water in the other boiler. This is very unpleasant to say the least, so that it is very natural for the engineer in charge to object to high-water alarms, and who will blame him for such objection?

As a matter of course, the remedy lies in having both furnaces at the same temperature, or in shutting off the connection between the two boilers. It is scarcely possible to always do the former, and it is inconvenient to do the latter.

About twenty years ago in the city which is the home of the writer, there was a disastrous boiler explosion. Immediately thereafter there was a law passed requiring all boilers in that city to be fitted with low-water alarms. At the present time I believe that there are not a half dozen of them in use. If they were necessary twenty years ago they are still necessary, and it follows that if they are not needed now, they were not then. The following is a reason for this state of affairs: When a low-water alarm is first put on to a boiler, the engineer or fireman is very careful to avoid bringing it into use, but after a time it gets to be an old story, and he rather depends on it to give him warning when the water is getting low. Then comes a time when the apparatus is out of order and consequently fails to work; when the engineer discovers that he has been leaning upon a broken reed which fails to give him support when he needs it. I am simply giving these facts as I find them.

Again, some of these high water alarms are so arranged that they cannot be shut off from the boiler when they are out of order. There is a reason for this, as it is intended to make it impossible to prevent them from sounding at proper times, but if they become deranged in the course of time, it is well to have it so arranged that it will not be necessary to cool off the boiler to repair them, for in many cases this means a shut-down for the entire mill or factory. The best appliance for this purpose is an intelligent well paid engineer or fireman, for no apparatus has yet been devised that can do its work along this line at all times.

Machine Shop Milling Practice.—IX.

By Horace L. Arnold.

In further pursuit of my purpose to place before the readers of this journal something like a complete record of the present status and practice of milling in machine shops, I recently visited the shops of the Brown & Sharpe Mfg. Co., at Providence, R. I.

Inside the Brown & Sharpe shops I was made to feel that the place was wide open for the inspection and information of any one who cared to know what it contained, and that the full knowledge of its experts and specialists was also on view; and I further found what always must be found among real experts, that these gentlemen expressed absolute certainty of conclusion on only two points, and the same two in every case—that they had done the best they knew how to do, and that they hoped, since hope springs eternal in the human breast, to ameliorate some of the faults of their past work by future effort. Thus the man who had been the most years with the milling machines said, "We do a good deal of machine work with mills, but when you come to milling, we do not think we know anything about it. Some days we think we have made up our minds about something, and later on we think we will change our minds; that is as far as we have gone; we *know* we are doing the best we know how to do, and we think from what we can find out we are doing somewhere near as well as anybody does, and we are doing better and faster work all the time, and we shall keep on trying till we do find out about milling, if somebody else does not find out about it before we do, and tell us."

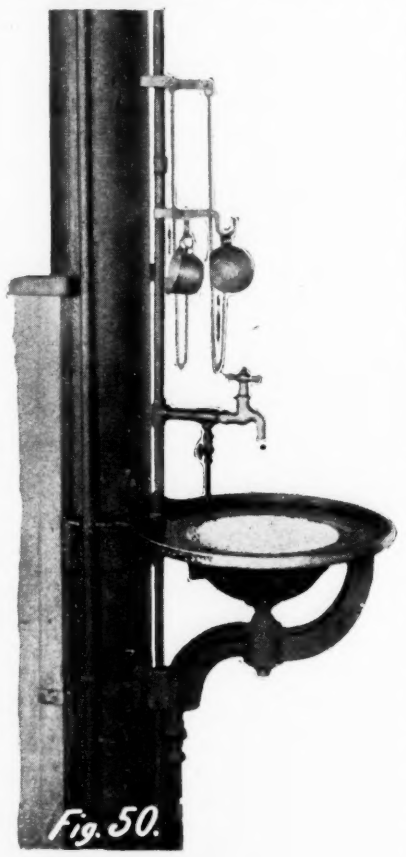


Fig. 50.

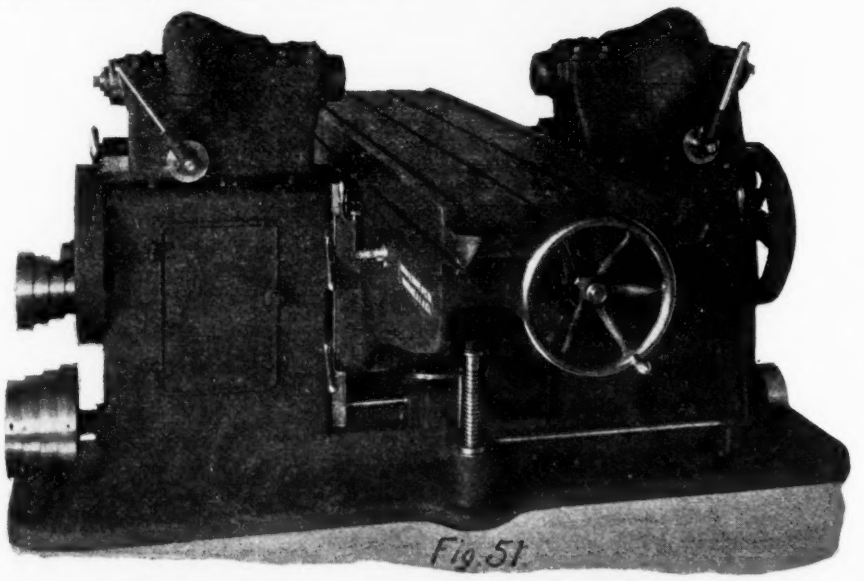


Fig. 51

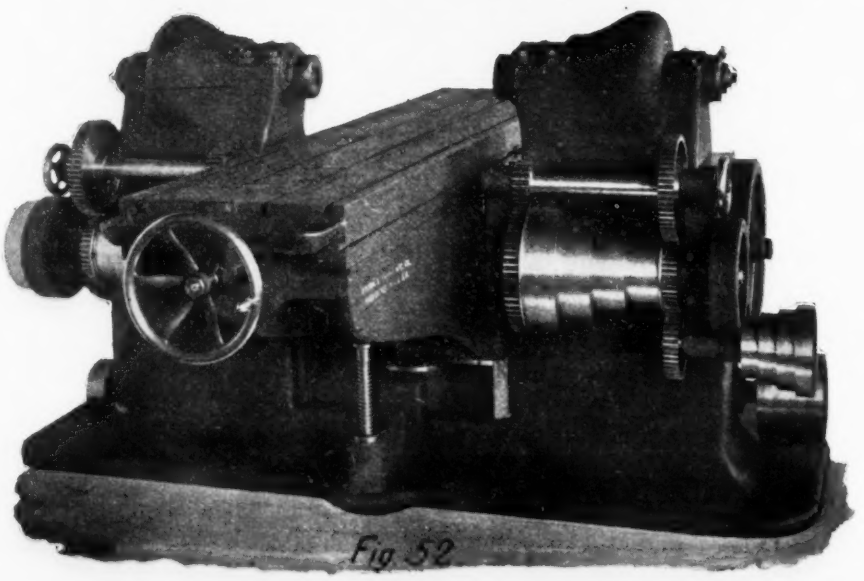


Fig. 52

With this gentleman for a guide, and a photographer who produced excellent pictures, I went among the milling machines at Brown & Sharpe's. What I saw in particular will be shown in the engravings; what I saw in general was a wonderful and admirable attention to details, a surprising adherence to one type and size of milling machine for machine work, and, probably, a direct consequent of these two conservative factors, a wonderfully large result in the way of stock removal or extent of cut per pound of milling machine. I saw work performed at a rate of speed which made me doubt the accuracy of my watch, and other machines working on pieces which looked bigger than themselves, and I saw the milled pieces produced in a shop test to decide the relative advantages of milling with and against the feed, and which gave the Brown & Sharpe Company the conviction that for them and their machines, the old way of milling against the feed was the better way; and at last, as at first and all the way through, I saw more distinctly and prominently than anything else that tireless attention to the smallest details, that careful making the most of every point of advantage and every possibility of gain, no matter how small, which, as the small often includes the great, is perhaps no where shown in the Brown & Sharpe shops more strikingly than in the fountains which supply drinking water to the men, and of which one of the great number in use is shown in Fig. 50. The horizontal faucet supply taken from the vertical supply pipe has a small, constantly flowing downward branch discharging into the basin; at a convenient height a double branched nickel-plated cup holder with gracefully curved ball tipped hooks, sustains two nickel-plated drinking cups, kept by chains leading to a double-branched nickel-plated chain holder secured above on the vertical pipe. The water is pumped from an artesian well to a high tank, and is taken through the vertical supply pipes on its way up; the small, constant discharge at each faucet branch keeps the water always fresh and of uniform temperature at each faucet; the catch basin keeps the floor dry, and the nickel-plated cups are always clean and inviting; the graceful shapes given to the basin and its bracket and to the cup hooks and chain supports make the whole fountain a pleasure to the eye as well as a perfectly satisfactory solution of the problem of supplying drinking facilities to a great number of workmen without one disagreeable feature. I never before saw drinking arrangements for working men which any one not hardened by a long shop training would willingly use, and the complete adaptation of means to an end shown by this simple drinking fountain, typify to my mind the principle ruling characteristic of the Brown & Sharpe shops.

There are only two types of machine work milling machines in Brown & Sharpe's, and only one example of the larger of these types, and that one machine, shown in Figs. 51, 52, 53 and 54, is not regarded with entire favor by its makers, although it is an excellent machine, having a very large and convenient table, adapting it to a great variety of work, with side or axial mills; for, much as I grieve to say it, though the Brown & Sharpe *catalogue* says "axial," "radial," and "form" mills, the Brown & Sharpe shop *men* say "side mills," and "end mills," in illustration of the ineffaceable permanence of English in the shop.

The principal operative limitation of this largest example of the "Grant" form of milling machine lies in the very short endwise adjustment of the spindle heads, which in some degree limits the convenience or the effectiveness of the machine in the use of end mills. The table is well supported, very wide and very long, for the style of machine, and the spindles, though bevel geared, are very strongly driven, and the machine takes a very smooth and steady cut, as might be expected, from the massive framing, and the two end drive of the mill arbor. Whatever faults this machine has are due to its type, and I do not expect to see the "Grant" type of double spindle milling machine abandoned; on the contrary, I expect the milling machines of the "Grant" form, with two driven spindles having horizontal adjustment only, and a table having a vertical adjustment to come very largely in use, as they have advantages

not to be lightly overlooked. I need not say that the fitting on this machine is magnificent.

The weight of this Brown & Sharpe "Grant" machine was given at about 14,000 pounds; the mill spindles have about 6 inches horizontal adjustment each; the bed has 12 inches vertical adjustment, and 96 inches feed travel, given by a 4 per inch screw. The table is 24 inches wide. The spindle adjustment is by a rack and hand actuated pinion, and the drive is two 3½ inch belts on two 4 step cones, back geared. The spindle gears are covered, and in general design the engravings speak for themselves. The cut I saw being made was a bicycle rubber tire mold, 5 inches wide, steel; cutter, 3 inches diameter, 20 revolutions, 14 teeth, 1¾ inches feed per minute, giving surface speed of cutter, about 16 feet per minute; feed per tooth, 0.0125 inch.

I give also a large cut of the same machine working on two pieces of cast-iron, showing the construction of the mills, mill arbor, and milling fixtures, everything as actually at work. I have not the particulars of this cut, but the appearance of the chips shows a large per tooth feed. It will be observed that in this case, as in most others in the Brown & Sharpe practice, the work is held on a special fixture bolted to the machine table. I give prominence to these tool details of the Brown & Sharpe practice, as they are of the very best description, and will serve to give a general idea of what users of milling machines must expect to provide for each job of rapid finishing. A good idea of the size can be gained by remembering that the table and fixture base are 24 inches wide.

Fig. 54 is made from a working blue print, and shows the double bevel gear spindle drive of this large Brown & Sharpe machine, which is totally different from anything shown before, and yet seems to be perfect in action, and so is only one more seemingly unsuitable thing which works perfectly well in a milling machine.

LETTERS FROM PRACTICAL MEN.

War and its Value Again.

Editor American Machinist:

"Bell Crank," in his good-natured criticism of the writer's article on "The Mechanical Value of War," seems to object more to the ideas therein expressed concerning the Peace Congress than to the assertion that war has aided the development of mechanics.

Can "Bell Crank" name any one thing that has made greater demands on the engineer since the records of the world began, than war has done?

Can he name any two things that have done half as much? And this is exactly the point in the article on "The Mechanical Value of War," viz., that it has been the greatest of all helps to mechanics.

It takes but a glance at the past to see that war has been looked upon as a leading factor in the history of nations.

If "Bell Crank" will look about Westminster Abbey, he will notice the great monuments that are raised to the memory of those whose chief distinction has arisen from the taking of human life, and, if he looks with care, he will find in one corner a small marble bust, placed in honor of one of the discoverers of anæsthetics—a strange contrast to contemplate—the veneration of those who inflict human suffering, and the slight regard for those who alleviate it.

"Bell Crank" admits the mechanical value of war, and we differ only as to the amount of good it has done.

He asks, "Which is best for the future, peace or war?" There is but one answer to that question. It is, peace. To obtain this there are but two ways—to have the teaching of Christ so prevail as to become the universal rule of life, or, so to perfect the mechanical appliances of war, as to render it too dangerous to enter upon.

The former bids us turn the second cheek if the first is smitten, but that presupposes that there is war enough left in somebody to do the smiting, and we must rest our hopes on the final diffusion of brotherly love.

Meanwhile, the second alternative bids fair to bring about that most desirable end—peace—the more quickly, in that, the better the weapons, the fewer the wars.

Arbitration is the sensible method of adjusting national disputes, but the only way to induce nations or individuals to adopt it, is to have them thoroughly imbued with a grave doubt of their being able to whip in a fight; then they will submit to arbitration. In short, peace in the future is best indeed, but it will have to be maintained by perfectly equipped armies.

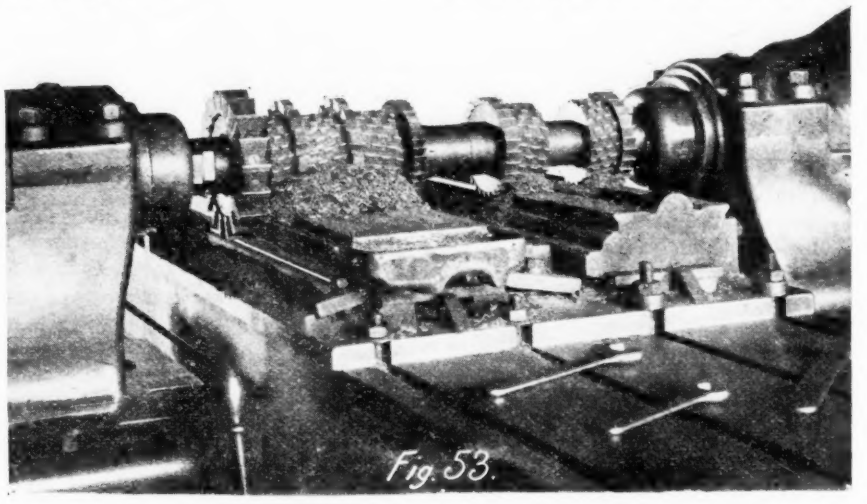


Fig. 53.

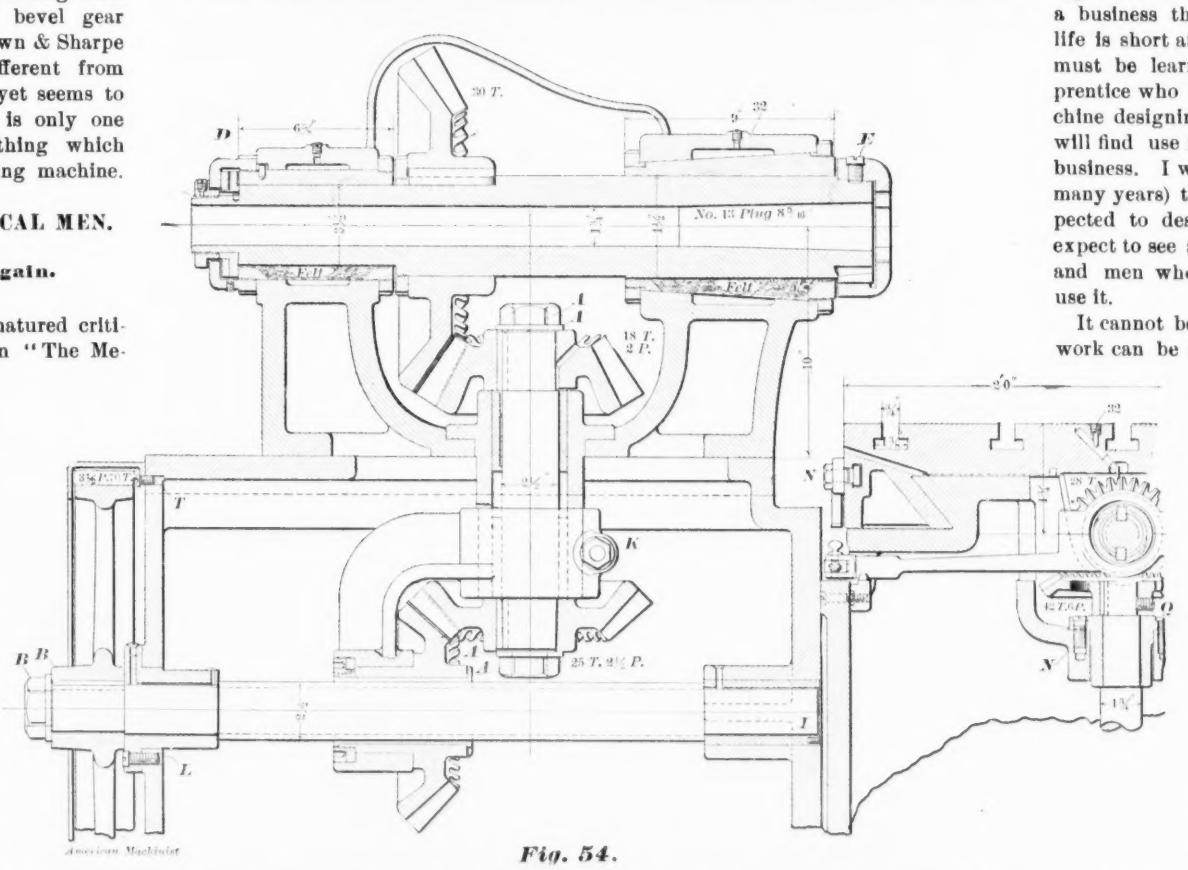


Fig. 54.

Just why gunpowder should be replaced by anything else, the writer fails to see. It opens our tunnels, blasts the rocks for our constructions, is a splendid servant to the civilized world, and a necessity to the pioneer in new countries.

The question, which is better, to make books or to make whiskey, depends upon the quality of both. If the books are like "Tom Jones" and similar productions, then the making of whiskey is a better employment. Good whiskey is better than bad books.

Of course, the Chicago fire did good—so does having a tooth drawn, or a boil lanced.

It is the question of present discomfort as against future benefit.

If "Bell Crank" thinks gunpowder should be done away with because it can be put to a bad purpose, why should he encourage the raising of grain, as it can be and is made into whiskey, which gets into the heads of foolish people who drink too much of it. If this line of argument is to be pursued, suicide seems the only thing left for us all.

Peace is good, but a Peace Congress is questionable—just as "fish is good, but fishy is abominable."

Of all nations, we can afford to mind our own business, a condition that few others enjoy; and the sending of petitions to the heads of nations praying for the disbanding of armies, is as impertinent as it is useless.

We should resent any suggestion from foreign rulers about our treatment of the Indians or the size of our army as quickly as any nation, yet, under the name of a Peace Congress, we are willing thus to waste our energies.

Going out to kill each other with highly finished weapons is not a pleasant spectacle to contemplate, and that fact, coupled with those same effective weapons, makes us continue to contemplate instead of going out to kill. Our respect for what the weapons can do makes us think twice, and we stay at home.

The great advance in the perfection of weapons is doing more for the cause of peace than any body of mere talkers can ever do. The silent Gatling is a grand peacemaker; the mere existence of a commander like Von Moltke did more for peace than all the petitions ever presented.

True, the mechanical arts advance without war—would have advanced had war never existed—but more slowly than they have done; and in the perfect preparation for war, and in the perfecting of engines of destruction, the mechanic is doing more practical work for peace than any deliberative body can ever do, even though it be dignified by the name of the Peace Congress.

W. D. FORBES.

About Drill Jigs—Square-threaded Screws.

Editor American Machinist:

As the *manufacture* of machinery is of comparatively a late date, there are a great many who do not realize the full value of drill jigs; there are also many who have mistaken ideas of the cost of such tools and their real objects. The first and real object in using a drill jig is to do the work cheaper than without it. To do the work better is impossible if it was done well enough without it. I would not be surprised, in time, to see jig making and jig designing combined in one man's business. Any one who has a good understanding of the practical side of machine construction can readily see that of two men of equal brain power and equal theoretical education, the one with the greatest experience at actually working on machine tools and using jigs in every-day life, will design a drill jig, so as to be the cheaper to make, the handier to use, and the more lasting.

A few years ago boys while serving their apprenticeships in machine shops did not have such a good chance of learning drawing and the theoretical part of machine designing as to day. I have seen a great many apprentices in the last few years who attended evening schools, and were trying hard to learn more than could be learned in the shop. Some say that these boys are educating themselves for fools, that they will only learn enough of each business to enable them to make fools of themselves in anything they undertake. This old theory that a man's head will only hold a certain amount should have taken a "tumble" years ago. It is true that a person should not use his time learning Greek and Latin if he intends to follow a business that will never call for it, for life is short and there are many things that must be learned; but any machinist's apprentice who takes sufficient interest in machine designing to study it outside the shop will find use for all he learns in his line of business. I would not be surprised (before many years) to see toolmakers who are expected to design the tools they make. I expect to see a drawing board on the job, and men who know how to use it and *do* use it.

It cannot be denied that many kinds of work can be done cheaper, and more satisfactory, where a man does his own designing, drawing, patternmaking, blacksmithing and machine work.

I expect some to say this is a radical idea, and, of course, it is, but it can be readily proven when you have the right kind of men on the job. But some one asks where I am going to get these right kind of men? Some of these apprentices who attend evening schools after working 10 or 15 years at the business, at all around machine work, and in a sufficient number of shops to get over the idea that they learned it all in B's shop, and after having some experience at patternmaking and blacksmithing, will fill the bill first rate.

I have heard of men saying that toolmaking is a trade by itself, but I want to say that any good machinist who possesses a good set of brains, and is not too lazy to use them, and who has had a fair amount of experience on small work, can make tools good enough for anybody.

To learn enough of patternmaking to be able to make patterns for castings good enough for the purpose will not take a good mechanic long, and then if there are forgings to be made that he would not be able to make, he can make a wooden pattern for the blacksmith which will suit the average run of blacksmiths better than any drawing. I hope no one will undertake to answer this with that old "chestnut" about the small capacity of men's minds.

Here is my ideal equipment for a tool job:

First Department.—A suitable equipment

for making working drawings with good light and a good place to wash the hands; also a liberal supply of manilla paper.

Second Department.—A suitable equipment for making wooden patterns. As this is not a *manufacturing* department it will not require much machinery.

I will suggest, as the men I would propose to work in it would be more of machinists than wood-workers, that an engine lathe without back gears be provided for this department. If speeded high my experience goes to show that it is more suitable for machinists' use, and I am not so sure that it is not more suitable for pattern-makers' use than the common hand lathes if they would learn to use it. A good glue pot and shellac can, with something in them, should not be forgotten any more than a large piece of beeswax.

Third Department.—A blacksmith's outfit, remembering, as in the pattern department, this is not for manufacturing purposes. A gas blow-pipe and Bunsen burner would belong in this department.

Fourth Department.—The regular machine department now common, except that I would recommend better tools than are sometimes found.

I should expect by this arrangement to get as much work done with one man as is common to do with two. If there are to be any mottoes on the walls (which are not necessary) I should make them something like this:

Good enough for the purpose.

Find out the purpose.

Use good judgment, but if you have not got any, work somewhere else.

The idea of making a drill jig accurate to as near as .001 inch for drilling holes for rough bolts $\frac{1}{16}$ inch loose, is rather too modern for my use. The idea of having a college graduate make an elaborate drawing of an elaborate jig, for an insignificant purpose, and give all dimensions to the thousandths of an inch, and then paying a high-priced machinist for working every dimension as close as possible, regardless of cost, or purpose, is another one that is a little too modern for me. To pay a high-priced designer and draftsman for studying out a drill jig that seems to "fill the bill" from his point of view (which is often such a high point of view that he looks right over the real object), also to study out all the possible ways of making such a jig so as to be able to design one that can be made at the least expense, and still "fill the bill" (which he is often not capable of doing), also for making a drawing to convey his ideas to the others who are to work on the job, then to pay others for a lot of preliminary work in studying out what is wanted before being able to go ahead on the real work, is still another idea that is too modern for me. Of course, I do not mean to say that this argument will hold for all classes of work, but on *special* tools and on *special* machines I have great faith in it.

In your issue of May 3d, Mr. McGregor says he has *heard it said* that the only reason why we use square-thread screws is because grandfather used them. I have been thinking that perhaps we are going along all right in grandfather's trail in this matter.

Of course, the most common reason why square-thread screws are used is because they work with less friction in their nuts than screws with angle threads. This is not the only reason, but it ought to be sufficient when we come to consider that for a long screw to work without end "backlash" in its nut throughout its length, it is the cheapest to make of any, that is, to cut accurately to pitch.

There are some who evidently do not admit that a square-thread screw will work with less friction than one with angle sides, judging from their favorite Schiele step bearing for vertical shafts; but I notice that these same people will expect a taper arbor to have more friction in a taper hole than two flat disks of same diameter pressed together with the same force. I also notice that in steamships they do not use the Schiele curve or any kind of angle collars in the thrust bearings. Perhaps some one had better start a reformation.

There is another reason for using a square-thread screw that has still more weight with me. In most slide-actuating screws the screw is confined in close bearings, or at one end at least. If the screw is a tight fit top and bottom of thread (or its equal, an angle sided thread which is self centering regardless of looseness) then the bearings must be exactly in line to allow the slide to work freely; but if a square thread screw be used and it is made practically right, that is, about .005-inch loose top and bottom of thread, then practical work is allowable in bringing the bearings in line, and still the slide can be expected to work freely. I have known of men who insisted upon having ordinary square-thread screws bear top and bottom on the threads, but by what manner of reasoning or practice they arrived at this conclusion I am unable to say. I should like to know and hope some of the readers of this paper can answer the question. I think that screws are often made too tight for good lubrication. A screw originally made loose enough to allow of a good film of oil throughout its nut will wear smooth, but one fitted so as to force the oil off the screw when it enters its nut is apt to "rough up" and wear out in a short time.

I have an idea that for ordinary bolts there is no need of half so close work in fitting the threads as is common. I suggest to some college where they have apparatus for testing, that two bolts be made equal in every way, except that one be a good fit in its nut and the other be loose, or what we might call loose in practice, that is, for a $\frac{3}{4}$ bolt .005 inch loose, then pull the bolts through their nuts, and report in the AMERICAN MACHINIST the result, that is, the force required in each case. If it is not really necessary that bolts be good fits in their nuts, a large amount of expense can be spared and still have them interchangeable.

Some machinists despise theory, but if they only had a little of it, they would not be getting into so many scrapes. Theory teaches that a screw and nut will not work together unless their pitches agree as near as the end looseness in the threads will allow. It is evident that (with a nut 4 inches long) if the pitch of the nut only agrees with the pitch of the screw to as near as $\frac{1}{64}$ inch in 4 inches, that the threads must be rather more than $\frac{1}{64}$ inch loose sideways, to allow of free running. When a man cuts a square-thread screw with a tool the same width as the one used to cut the tap in another lathe whose lead screws do not agree for pitch, it ought not to be wondered at that the nut will not go on, but it often is.

Blind practice does not seem to explain this matter, for men keep right on wondering over such things, and I have seen men do considerable sweating, not saying anything about the time wasted, and the swear words uttered.

There seems to be a pretty fair chance for some one with brains in a machine shop, when the muscle gives out.

Some recommend very accurate lead-screws for lathes as the means of correcting all the evils. It is well known that lathe lead-screws are subject to wear; that no matter how accurate a screw may be when new, it may be in very bad shape after a few years of wear. I do not pin my faith of good work on the fact that some one at some time did an extra good job, but on the kind of men themselves who do the work. I expect if a man be intelligent enough, and honest enough, to do what he believes is right, that when he finds a lathe lead-screw sufficiently bad to make a hurtful difference in the work produced, that he will have it fixed right away. You cannot do good work right along "year in and year out" any other way. Some say, for self protection, I will buy only from old well known concerns. Now, the name of a firm does not insure you anything, no matter if it has been rung in your ears as long as you can remember. Now, simply the name The Great North American Machinery Manufacturing Co. does not amount to a cent. I should rather know something about the kind of men they employ. A place where the help is continually on the move, where no man stays long enough to become at all accustomed to the work or the shop, where no man takes any interest further than to get in his time and receive his pay, and where every workman is continually at war with his employer, is usually a place where bad work is done, regardless of rules of inspection and high-sounding titles.

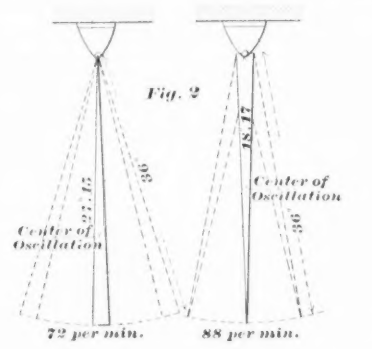
Is it not better to pin your faith for accurate or good work on honest, intelligent, satisfied workmen, than such a very uncertain liable to-wear-out matter as an "accurate screw?" A MECHANIC.

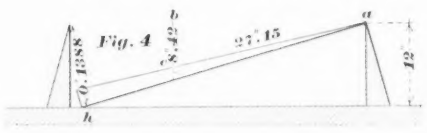
The Gravity Problem—Turning Balls.

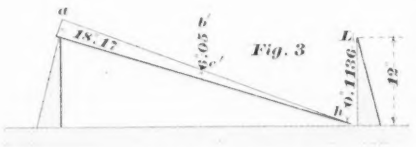
Editor American Machinist:

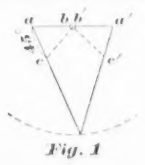
Referring to the problem in physics as proposed by Mr. Leicester Allen and published in your issue of April 26th, will say: The lighter end of the angular bar will drop quicker than the heavy end, and when both ends are released at the same time the velocity of the two ends will be uniform, at least theoretically so. Although were the fall to cover a greater distance the resistance of the air would evidently retard the thin end.

I regard this problem as embodying the









elements of the pendulum, pure and simple. If right in this, then my conclusions must be practically correct.

To find the centers of oscillation was all that was necessary, then, to determine the velocity of either end of the bar; when the light end of the bar was taken as the fixed or suspended end, the center of oscillation was found by Haswell's rule, which gives this point in an isosceles triangle as .75 of its length. But when the bar became inverted we were at sea without a compass. So, an experimental method of finding the center of oscillation, with the figure suspended by the heavy end, was adopted. The density of the material forming the angular piece not being essential seasoned oak was used, and the dimensions as given complied with as near as possible. Suitable pivots were fixed at the points of suspension as shown in Fig. 2, and a practical test showed that the vibrations per minute were 72 and 88 respectively for the two positions, and from which the following is deduced. Taking the length of a pendulum at New York at 39.10 inches, then $39.10 \times 60^2 = 140{,}760$, a constant, which if divided by the square of any number of vibrations, will give the center of oscillation in inches due to the number taken. In this case $72^2 \div 140{,}760 = 27.15$. A slight discrepancy, it will be seen, exists between this, and that secured by taking .75 of the whole length of the angular piece, as before stated. Using the same formula for the inverted pendulum, we have $88^2 \div 140{,}760 = 18.17$ inches as the center of oscillation in this case. As to this last being the correct proportion for any other triangle, I am not convinced; yet it would seem that the neutral material at the vertex of the pendulum increases proportionately as the length of the sine of the angle.

What I term as neutral is that quantity lying within the radius of the sine, as shown at a, in Fig. 1, and bounded by $a\ b$ and $a'\ b'\ c'$.

This weight acting on both sides of a line vertical to the point of suspension eliminates the action of gravity, so far as it operates to swing the pendulum.

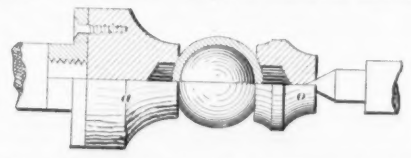
In Figs. 3 and 4 I have shown the angular pieces resting in the position assumed after they fall, and in these diagrams give the relative distances of the centers of oscillation c and c' from their resting points at a, and also the vertical height through which the points c and c' have moved from the points b and b'. These distances, together with the distances from c to a, become, of course, essential factors in determining the number of vibrations such a bar will make per minute, or, in other words, to tell how long the points h and h' will be in falling 12 inches.

Having secured in this case the number of vibrations per minute by experiment, and taking the axiom as given by Haswell as true: That the velocity of a body in oscillation through a vertical plane, is equal to that acquired by a body freely falling through a vertical line equal in height to the versed sine of the arc, I make the time of descent from k to h, Fig. 4, to be 0.1388 of a second, while that from L to h', Fig. 3, will be 0.1136 of a second.

Releasing both ends of the bar at the same time it will fall 12 inches in 0.241 of a second.

I do not feel competent to follow up this problem, or even to outline the principles involved, as they may apply in mechanics. It evidently cuts a figure in fly-wheel governors, but such calculations are too abstruse for my dull comprehension. I have attempted to follow some of your able writers on this subject, but gave it up in despair.

We notice the question asked, in a recent issue, as to the best method of turning metal balls perfectly spherical. Mr. R. C. Greer's reply in May 10th issue seems to cover the ground, but it may not be out of place to describe here, what is probably a more primitive method, yet one which we have used with good success. The balls which we turned ranged from $2\frac{1}{2}$ inches to 3 inches in diameter, and were cast hollow. The vent holes were threaded and plugs screwed in, but before cutting these off, the ball was roughed out approximately to the proper form, and the stems cut off. A chuck was then used of the form shown in the sketch, where a is a piece of hardwood attached to a small face-plate, this is turned to the proper size, and a concave, suited to the size of the ball, made at the end. The central portion is removed so as to allow the ball to bear only at the outer edge. A piece o of similar shape is made of metal.



The ball is placed first in a transverse position from that in which it was roughed out, and a skimming cut taken off, preferably with a hand tool. After reversing and turning in this way two or three times, the lathe center is slackened sufficiently to allow the ball to change its position whenever the turning tool takes an excessive cut. This soon produces a sphere practically perfect.

Of course, when much of such work is required it is infinitely better to provide special appliances. "QUIRK."

Information Wanted About Tool Rooms.

Editor American Machinist:

Mechanics from different parts of the country have from time to time given to the readers of the AMERICAN MACHINIST valuable suggestions in regard to toolmaking, but we see little about tool rooms. I wish some of those who have wrestled with the problem would tell us something about tool-room systems. I do not wish to be understood as saying that too much has been written about toolmaking, but rather that too little is seen about methods of keeping tools in a cleanly manner, and so that when wanted they may be readily found. I know of many systems which have been tried that left much to be desired, and so believe that a discussion of tool-room systems would prove highly beneficial to many of your readers. WM. H. STEDMAN.

Human Nature in the Shop.

Editor American Machinist:

The remarks by "Presto" in your issue of April 12th, present volume, as to "human nature" as evinced by the workmen in our shops, has brought to my mind some of my past experiences, and I feel inclined to express a few of them. Though I do not wish to do any injustice to the craft, or raise an unlimited discussion on the question (yet I believe it will stand a little airing), I do believe that more consideration is given to the men by those who have charge of our manufacturing establishments, and all others as well that employ, than they get credit for. There are a great many obstacles in the way and to be considered in dealing with workmen, and though they do not always appear in the transaction, have yet been recognized. I believe the men as a body are somewhat to blame for the wages they receive as individuals. Several years ago I remember asking the foreman under whom I was working for a raise in my pay, and the answer, though not encouraging to me, yet I believe to have a good deal of truth in it, and the principle holds good in the main in nearly all shops. He said: "Frank, I believe you are worth what you ask, but if you are raised I must do the same by several others that are getting all they are worth, and so I cannot give it to you." It was only after considerable persistency on my part that he gave me the desired raise, and only then after a solemn promise on my part to say nothing of it. Human nature all around. I want more pay; if I get it the men will object, and the foreman wants to keep expenses down, and tries to shift the question.

I knew of a young man, a good mechanic to day, that in his younger days when not so well experienced, entered a shop as a workman, and every obstacle was placed in his way, such as hiding the tools, etc., the result being that he was placed on the list for less than he was worth, which he had to take or resign, and the men had a low-priced though fairly efficient workman to compete with. Is the proprietor to blame? He judged the man by what he did at the first, and believed that his judgment was correct; and we all know how hard it is to convince them of increased worth after the price is made. Employers are, a great many of them, busy men and really do not have the time to consider minutely every individual workman's case presented (and at all times), and the case is slighted and nothing done. Sometimes the foreman is left to set the wages, and is also held responsible for expenses.

John comes along and wants his pay raised, foreman thinks about it, yes, John is a good workman, in some ways, willing to do all he can, and does very good work, but he is wasteful in many ways, that increases expenses, and that reason is considered sufficient for not giving the desired increase in his pay.

There are a great many things come up to the foreman when he is trying to do justice to all concerned, and there is no doubt but a grain of human nature or a little selfishness creeps in unawares at times.

Fair treatment does not always get a just reward. I have, while in charge of men, tried to treat them in the best manner I knew how, and have had them do all they could to injure me, and I can cite a number of instances where others have been dealt with in the same way, and all the result of human nature.

I believe, Mr. Editor, that there is room for us all to do better in our treatment one of the other, but will we do it? The employer for workman, and the workman for the employer, and the foreman for all concerned.

There is much that might be written on this subject, but I have taken more space than I ought already, and will not say more. Hoping that a thought taken from this may lead to more thinking, and that at least some one, if not many, may receive a benefit from it. F. J. JONES.

Contract Work in Machine Shops.

Editor American Machinist:

The greatest problem with which manufacturers have to deal nowadays is how to get their work done the cheapest possible way and yet maintain their standard of workmanship.

Comparatively few of the manufacturers of this country have ever thought of seeing how contract work would go in their shops, and yet they make the same machine from one end of the year to the other, and very often in large quantities; the majority of them seem to think that with the introduction of contract work in their shops good workmanship disappears, but from the writer's experience in contract shops such is not the case, as a workman knows, whether he is working contract or not, that he has to do his work right, providing, of course, that he has a wideawake foreman to examine his work. Manufacturers who have their men working contract are benefited in more than a financial way from the fact that men working piece-work take an interest in new tools, jigs, or anything that would facilitate the completion of a job and, in that way, would increase the output considerably, and the men would be making a fair recompense above their daily wages. It is a well-known fact that it is not always the man who works the hardest who turns out the most work; in other words, the man who waits until he has one operation finished before he starts to think how he shall proceed with the next one is not the one who does the most work, but the one who, while doing one piece of work, has his plans all laid out for the beginning of the next piece of work is the one who is able to turn out the most work.

Although there are a number of machinists who work on the latter plan there would be a much greater number if they were working piece-work, and they would still turn out first class work at a much smaller cost than if they were working day-work.

W. F. BROWN.

Steam on Common Roads.

Your article has brought me back to my early days—about the year 1853—when Captain Morrell was desirous of having a small passenger road locomotive. I designed one for him to run at about 10 to 12 miles an hour on common roads. When we proceeded with it and got some of the parts made, we found that the authorities would not permit us to use it, the same being contrary to law. Thus the matter has been shelved for upwards of 40 years. The importance of this question cannot be overestimated, as a large trade would be opened up for the use of road locomotives for heavy goods traffic, also for medium traffic, such as carriers' vans, parcels post, etc., from one small town to another, and an innumerable quantity of light passenger road locomotives to run at quick speeds.

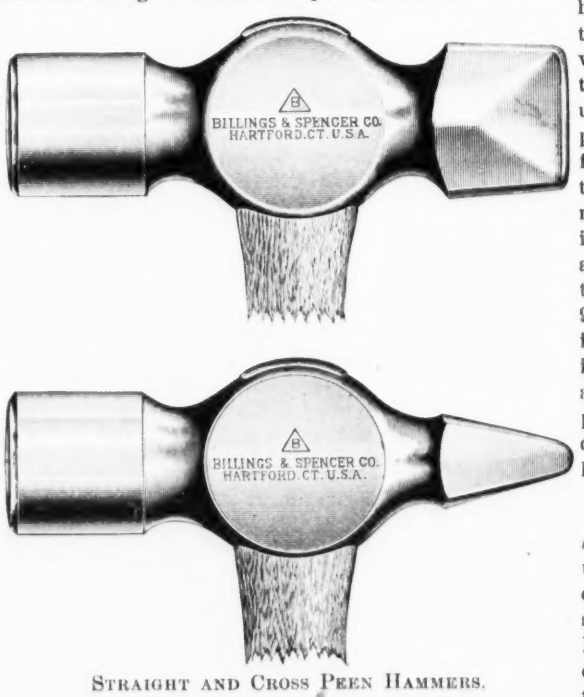
They could be made to run almost noiselessly and free from all nuisance, and be under perfect control, and thus, as you say, accidents would be avoided. The wear and tear on the roads with such machinery would be greatly reduced, thus affording great relief to the ratepayers.

As to economy in running, the cost of fuel and lubrication, upkeep, and interest on capital would be so low that those unacquainted with it would hardly believe. It could certainly be done very well under a penny per mile, and since the engines could be very neatly designed, and the engine parts properly covered up, most persons using them would soon become acquainted

MULTIPLE SPINDLE DRILL PRESS.

with them and be able to work them without having an attendant. There is a great field for these engines, and that they would eventually supersede horse traffic is, as you suggest, almost certain.

I sincerely trust that the competition (promoted by the proprietors of the *Petit Journal* in offering prizes for the best types of these engines) will stimulate this business and bring it before the public, and thus, so to speak, educate them in the way of using them.



STRAIGHT AND CROSS PEEN HAMMERS.

Whilst the Continental towns are going ahead we are at rest in England, simply through an error in the law. It certainly does seem a great pity that a manufacturing country like England should be so handicapped as it is by prohibitory laws, not only in the use of road locomotives, but in other things also.—*James Paxam, in Engineering.*

Adjustable Multiple Spindle Drill Press.

The accompanying illustration is of a multiple spindle drill press for light manufacturing operations, which is so arranged that its spindles may be adjusted and set in required order or position to suit the work in hand.

Eight or more short spindles in the upper bearing are driven by gears from the central shaft on which the large belt pulley is placed, and from the lower extremities of these spindles connecting shafts are led off at any required angle by means of universal joints. The lower or drill-carrying spindles are supported upon a plate having an opening through it and to the under side of this plate are fastened by bolts, brackets carrying the spindle bearings.

As the machine is shown in the engraving it is arranged for drilling the holes for spokes in a bicycle hub, and as the spindles cannot be set close enough to drill adjacent holes every alternate hole is first drilled, and the fixture in which the hub is held then indexes it for the remaining holes.

They may be arranged in any form to suit the work or fixture used.

The table is 12 inches by 8 inches, distance from column to center of table 5½ inches; vertical travel of table (feed motion) 7½ inches; maximum distance from table to end of drill collet 9 inches. The machine is made by The Pratt & Whitney Co., Hartford, Conn.

Straight and Cross Peen Hammers.

We have previously illustrated the Billings & Spencer drop-forged machinists' ball peen hammer, and we present herewith engravings of two other forms, viz., a straight peen and a cross peen, the hammers being in other respects the same, and especial attention being given to the quality of material used, sound forging, careful tempering, good finish and proper "hang." Both styles of these hammers are made in four sizes varying from ¼ pound to 1½ pounds, by The Billings & Spencer Co., Hartford, Conn.

In an article in *The Foundry*, by S. Groves, the writer dwells upon the danger of the hammer test on cast-iron pipes when under pressure. He instances two pipes which were subjected to a pressure of 260 pounds, in which condition a ball weighing 1½ pounds was let fall upon them from varying heights. The pipes were then broken, and against wherever the ball had struck there were star-shaped fractures on the inside of the pipe, extending into the metal from $\frac{3}{32}$ inch to $\frac{5}{32}$ inch. From this he concludes that a hammer test of cast iron pipes instead of being a safeguard is a source of danger. The pipes tested were 4 inches diameter, 9 feet long, ⅜ inch metal. He infers that there is a like danger in the case of all castings that are to be used under high pressure, and from which the cores are loosened by hard hammer blows.

A correspondent of *Engineering* thus describes the means used for removing a shrunk-on crank disk from a shaft, the shaft being in place. He says: I solved the problem, however, by drilling a ¼-inch gas tapping hole 8 inches up the end of the engine shaft, tapping the end of the hole, and inserting 3 feet of ¼-inch tube. Up this tube and hole I passed a 5 foot length of ⅜ inch tube, connected at its outer end to a flexible water hose. A good fire under the crank disk, and a plentiful stream of water up the hole in the shaft, soon did all that was necessary, and the disk was removed without further trouble. The ⅜ inch tube merely served to keep the water off the fire.

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The Armor Plate Frauds—A Department of Mechanics.

Two resolutions which have been offered in Congress show that there are those who desire that Congress shall make a full and complete investigation of the charges of fraud in connection with armor plate made at Carnegie's, and if half is true that has been alleged, there should certainly be the most thorough investigation by persons with both the will and the power to sift the matter to the bottom. Of course, it is unfair to decide such a matter from *ex parte* testimony, but the fact that a large fine has already been paid for defective work, shows that such work was possible, while the testimony as published regarding the question of still other frauds must be taken to contain much inherent evidence of accuracy. As an instance of this, the testimony of one Brown, who had been a laborer in the plate mill, shows either that it is true, or that it was fixed up by some one who was much more than a laborer, and, in short, a skilled and shrewd mechanic.

It seems that the force of government inspectors was not large enough to permit of their doing all the work connected with inspection, and therefore employes of the mills were detailed to help in the work; among them was this man Brown, who goes into particulars regarding the methods pursued to deceive the inspectors; which methods will be readily recognized by all shop men as being remarkably like what would naturally be done in such cases.

A man on a screw machine who had done satisfactory work in threading bolts for fastening armor plates, got a scratch on his arm and allowed stale oil to get into it, poisoning him so that he had to lay off. He was discharged, and a boy put in place, who spoiled a lot of bolts by threading them too small or stripping off the threads. They were rejected by the inspector, and, by Brown, placed in a separate box, and worked in with accepted bolts, those which had been made too short being gauged for length by gauges made to fit them, and at the same time, so as to resemble in appearance the genuine gauge; Brown using this gauge and the calipers in the presence of the inspector, and afterwards stamping with the inspector's stamp, the good and the bad alike. In other cases where bolts were seamed or "split in layers from one end to the other," grease was rubbed over them, and as the inspectors "were never very anxious to take hold of dirty things," these passed.

It got to be a regular thing, according to Brown's evidence, to pre-inspect bolts, and then, instead of submitting only the good ones to government inspectors for acceptance make gauges to fit them.

"It was an every day occurrence for me," says Brown, "to find bolts and screws under size, and I always reported this fact to the foreman, who had a series of templates made to fit the under sized bolts, but which were exactly like the inspector's templates in general appearance."

These templates were used by Brown "for the inspectors did not observe very closely while the tests were being made."

"It sometimes happened that the thread of a bolt was chased down below the limit and this would be found out when we placed the bolt in the plate at night, when none of the inspectors were present. If the bolt worked loose, it would be taken out and the thread battered a little or some sand placed in the hole until the bolt would fit tight, ready for inspection next day.

"Sometimes it was found that the bolt holes were not tapped straight, causing the bolts to stand out of the perpendicular. In such cases the bolts would be screwed into the plate and the part remaining outside bent by a sledge hammer until it stood at right angles to the plate. Afterwards the bolt could be taken out and straightened when the inspector was not present."

All this will be recognized as remarkably true to life, and no real mechanic can read it without being impressed with the fact that with any kind of a decent shop system, such as can be found in any number of shops in this country, such work would have been impossible, and accurate, good work could have been turned out at less cost, in any shop where the principles and practice of duplicate work in manufacturing operations are in the least understood.

No mechanic worthy of the name supposes, for instance, that because an inexperienced boy runs a screw machine the accuracy of the work must depend upon his skill, or the lack of it. And we all know that square tapping of holes is easily insured by very simple fixtures, and that with such fixtures the tapping is not only done properly, but usually at less cost than it can be done without them.

There is testimony also going to show that the testing machine, by which specimens from the armor plates were tested, was "juggled" and made to indicate the required strength, regardless of the actual strength of the specimen, and where a test piece was found to show too much elongation, it was first made about an inch above size, stretched in the machine the proper amount, and then turned down to the required size, the elongation appearing then to be all right.

In short, it would seem that ingenuity has been expended in concealing bad work, which, if better directed, might have gone very far towards securing work which would have needed no concealment.

The entire incident, together with trouble which is being experienced in connection with gun mountings, etc., simply emphasizes, it seems to us, our argument in favor of a government department of manufacturing or engineering. It is an anomalous condition of affairs which puts in the hands of soldiers the conduct of important mechanical operations, and it is especially disadvantageous when several different branches of the service must co-laborate to produce, say, a complete naval vessel, and each department is, and is, in fact, forced to be, more solicitous to secure the invulnerability of its own particular work, than for the success of the vessel as a whole.

We think it is at least as important that there should be a department of the government charged with the conduct of mechanical matters as that there should be an agricultural or a postal department. This is a country much devoted to mechanical pursuits. It is a pity we cannot arrange to give to our mechanics charge of our public mechanical work, and give them the credit for achievements in that line, instead of simply following in the footsteps of older countries, and letting our soldiers do their own manufacturing, at the same time keeping up a pretense or a semblance of military usages and traditions.

Let shoemaking be done by shoemakers; let battles be fought by soldiers, and let guns and other machinery be built by machinists working under the direction of men who are also mechanics.

Furnishing Libelous Information.

A section of the Penal Code of the State of New York was amended by the last legislature, and now reads as follows:

Any person who wilfully states, delivers or transmits by any means whatever to any manager, editor, publisher, reporter or other employe of a publisher of any newspaper, magazine, publication, periodical or serial, any statement concerning any person or corporation, which, if published therein, would be a libel, is guilty of a misdemeanor.

This act shall take effect September 1, 1894.

This we believe to be good common sense. No respectable paper desires to publish anything but the truth about corporations or individuals. At the same time, there is a natural and a commendable desire to publish news while it is news, and more or less confidence must be placed in those from whom information is obtained. Beyond doubt papers are often purposely misinformed, sometimes for the purpose of indulging personal spite and sometimes for other purposes. Those who do this deserve punishment, and it is a good law that provides for punishing them.

There are reasons for making the movable parts of a steam engine as light as is practicable, even submitting to a little springing of these parts. But the same reasoning does not apply to the fixed parts. There is no reason why the bed-plate, for example, should not be as rigid as the foundation, except the insignificant one of the cost of a few pounds of cast-iron, and a little more in the way of freight charges, perhaps. But even this, to-day, is largely a matter of education, not of the builders of steam engines, but of the purchasers. Sharp competition in the trade has crowded the room for profit into a remarkably small space, and to a large proportion of purchasers of two steam engines that look about alike, one is as good as the other. This being so, with the small margin for profit, even a few hundred pounds of cast-iron cuts considerable of a figure.

As an instance of the lack of discrimination on the part of purchasers, an agent in a western city was trying to sell an engine of the Corliss type, and was asked to call at the office of the company at a certain time. Going there at the time designated he found eleven others present on the same errand. Presently they were asked to submit their prices with the assurance that the lowest bidder should have the contract.

Now, if the demand had been for a quantity of pig iron, or lumber of a certain quality this would have been reasonable enough, but it is unreasonable to suppose that amongst a dozen builders of the same type of steam engines, one did not build a better—or a poorer—one than another. If they had always to sell in this way the inducement, if not the necessity, would be to imitate the poorer. Steam-engine builders by no means always build as good an engine as they would like to build; they are forced to build what the purchaser will pay for, and this, in the end, is likely to be unsatisfactory to both builder and purchaser.

A correspondent writes us a long letter, which is rather too emphatic in the way of language to look just right in print, but which is all about his having to pay a patentee for making and using a device that is "substantially fifty years old, although not used until within a few years." This is quite a common complaint, and one to which we have referred at different times. Such complaints, it appears to us, are generally without much foundation. The word "substantially" is too elastic, and when the matter is thoroughly sifted it is generally found that the old-time device would not work, and that something has been added to it, the addition being all that gives it value. It seems reasonable that the man who succeeds in making a device valuable should be rewarded, and not the man who attempts to do so and fails. And the courts appear to take very much such a view of the matter. For example, during the "Pop" safety valve controversy, when, after years of litigation, one of the cases came to the Supreme Court, Justice Blatchford decided it practically in this way.

Western dealers in silverware are said to make a point by advertising to give the weight of silver dollars in spoons, forks, etc. This at first sight seems a good bargain for the purchaser, but when it is considered that the silver dollar will pass for a hundred cents, while the silver of which it is composed is worth but little more than half that, the margin for manufacturing is seen to be quite a substantial one.

It is announced that as one result of the recent investigation of armor-plate frauds at Carnegie's, the board will recommend that "in future mechanical engineers and not sailors be selected to inspect government material," the inspection having been, up to this time, mainly by ensigns who have returned from sea voyages.

This will seem to most men who know anything of such matters to be a very wise recommendation.

However it may be in other things there is no slack times in the preparations of nations to annihilate one another. This is evidenced by the fact that the great Krupp works are fairly overrun with orders for big guns; some of these orders coming from countries that are practically bankrupt, and in which the people are taxed to the utmost limit of possibility. Along with the news of these orders for big guns, and the building of big warships, comes the news of the shooting of discontented workmen. Whatever connection there may be in all this it is as certain as anything can be that the greater the preparations for war the less the producing classes will have to eat and to wear.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(262) J. L. S., New York, asks: What is the smallest size of tank into which can be stored the gas from 20 tons of coal? *A.*—That depends on the thickness of sheets of which the tank is made, and the shape of tank. 2. How does gas compare with coal as a steam maker? *A.*—As a fuel, gas compares very favorable with coal, but it is too expensive to use. 3. Is there any loss in converting coal into gas before using it as a fuel? *A.*—Yes. 4. Can an engineer obtain a New York City license for running stationary engines, without first securing a position? *A.*—Yes; apply at the office of inspection of steam boilers, Police Department, 300 Mulberry street, New York.

(263) W. H. S., Barberton, O., writes: I have a marine engine 1¾x3 inches; ports, $\frac{5}{16}$x¾ inch; speed, 450 revolutions per minute; steam pressure, 100 pounds per square inch. I intend placing it in a boat 16 feet long, 3 feet 6 inches beam, and about 18 inches draught. What size and kind of propeller should I use? *A.*—Use a three-bladed propeller, 10 inches in diameter and 18 inches pitch. 2. Will not a horizontal return tubular boiler give better results than an upright tubular boiler for this engine? *A.*—The horizontal tubular boiler will be too heavy for your purpose. We should not use a tubular upright boiler; a plain upright boiler 25 inches outside diameter, 35 inches high; furnace, 19 inches diameter, 20 inches high; flue, 6¼ inches diameter, we believe, will answer the purpose.

(264) J. N., Winona, Minn., writes: I would like to have a little information on the following subject: I have a steel screw 2½ inches diameter, V threads, 4 threads to the inch. How many pounds pressure can I get using a lever 8 feet long, with two able-bodied men pulling on the lever, and what formula do you use in getting at the results? *A.*—Assuming that the point of application of the force acting on the lever is 8 feet from the center of the screw, then, in one revolution this point will travel through a distance equal to the circumference of a circle 16 feet diameter, which is equal to 50.26 feet, or 603 inches, fraction neglected. During the time that the point of application travels through this distance, the screw will move through a distance of ¼ inch, because there are 4 threads to the inch. Now, the product obtained by multiplying the distance through which the screw travels by the pressure it exerts is equal to the product obtained by multiplying the distance through which the point of application on the lever travels in the same time by the force acting on this point. These conditions will probably be better understood by expressing them in symbols. Let P = pressure of the screw in pounds, d = distance in inches through which the screw travels, F = force in pounds applied on the lever, and D = distance in inches through which the point of application of this force travels. We then have

$$d \times P = D \times F. \qquad (1)$$

Only about 40 per cent. of the force applied on the lever will do useful work, the rest being used for overcoming friction; hence, formula (1) should be changed as follows:

$$d \times P = D \times .40\ F. \qquad (2)$$

Assuming that each man can exert a force of 100 pounds, then, substituting for the symbols in formula (2) their values, we have

$$\tfrac{1}{4} \times P = 603 \times .40 \times 200,$$

from which we get

$$P = \frac{603 \times .40 \times 200}{\frac{1}{4}} = 192{,}960 \text{ pounds,}$$

or 96 tons.

(265) J. B., New York, writes: Please give me a rule for computing the speed of pulleys and shafting. I am a millwright by trade, but am not very well versed in the above subject. For example, the main shaft makes 300 revolutions per minute, it is to drive a countershaft at the rate of 400 revolutions per minute. Please give the size of pulleys which should be used for these speeds? *A.*—The product obtained by multiplying the diameter in inches of the pulley on the main shaft by its number of revolutions per minute is always equal to the product obtained by multiplying the diameter in inches of the pulley on the countershaft by its number of revolutions. Or, in symbols, let D = diameter in inches of the pulley on the main shaft; R = number of its revolutions per minute; d = diameter in inches of the pulley on the countershaft, and r = number of its revolutions per minute, we then have,

$$D \times R = d \times r.$$

If now the diameter of the pulley on the main shaft is 60 inches, and substituting in the formula this value for D, and the values as given in your example for R and r, we then have,

$$60 \times 300 = d \times 400.$$

Now, any one acquainted with the rules of common arithmetic will readily see from the above expression that the diameter d is found as follows:

$$d = \frac{60 \times 300}{400} = 45 \text{ inches.}$$

If the diameter of neither pulley is known, the above formula shows that the diameter of the pulley on the countershaft must be ¾ of the diameter of the pulley on the main shaft. This rule or formula is easily remembered, and is all that is required for the solution of any problem relating to the relative speeds of two pulleys. If, for instance, the diameter and speed of one pulley is given and the diameter of the other pulley is also given; then the speed of the latter is found by simply substituting these values for the corresponding symbols, and solve the problem by the ordinary rules of arithmetic.

(266) M. C. K., Green Island, N. Y., writes: I would ask you to help me out of a difficulty, as you have helped many others. I have a digester to make 14 feet diameter and 35 feet long, of steel plates ¾-inch thick; the top section is shaped like a long egg end. Please give rule for finding the length and breadth of template, and for finding the curves of the sides of template for the sheets, or give me the title of a book which will give me the desired information. *A.*—We understand you to ask simply for a method of finding the development of a sheet for a dished head similar in form to that shown in Figs. 1 and 2, the former being an end elevation, the latter a side elevation. The outlines in these figures represent the center of the thickness of the metal. We shall assume that six sheets are required for this head, $a'\ a'\ e$ showing the outline of one of them in Fig. 1. Let $E\ e$ be the center line. Divide the curve $A\ E$, Fig. 2, into any number of equal parts, the more the better; for the sake of clearness we have divided it into four parts only. Draw $a\ e$, Fig. 1, perpendicular to $E\ e$; through the points of division B, C, and D draw lines parallel to $E\ e$ intersecting $a\ e$ in the points b, c, and d; from the center e (Fig. 1) and with the radii $e\ d$, $e\ c$, and $e\ b$ draw arcs intersecting the radial lines $e\ a'$ in the points $d'\ d'$, $c'\ c'$, and $b'\ b'$. Draw a straight line $a^2\ E^2$, Fig. 3, and make its length equal to that of the curve $A\ E$ in Fig. 2. This is accomplished by laying off on $a^2\ E^2$ as many equal parts as there are in the curve $A\ E$; these parts in Fig. 3 must, of course, be equal in length to those on the curve $A\ E$. By these means we also obtain the points of division b^2, c^2 and d^2 on $a^2\ E^2$. From E^2 as a center draw arcs through the points a^2, d^2, c^2 and d^2, and make the lengths of these arcs $A^2\ A^2$, $B^2\ B^2$, etc., equal to the lengths of the arcs $a'\ a'$, $b'\ b'$, etc., in Fig. 1; these lengths must be laid off symmetrically from the line $a^2\ E^2$. Join the points A^2, B^2, C^2, D^2 and E^2 on each side of the center line $a^2\ E^2$ by curves; this will complete the development of the sheet extending to the center e. If now the radius of the crown sheet is equal to $e\ d'$ in Fig. 1, then the development in Fig. 3 must be cut off along the arc $D^2\ D^2$. No allowance has been made for lap. The above is the geometrical construction of the development; in practice good judgment must be used to make the proper allowance for contraction and expansion in bending the sheet to shape. There will probably be considerable contraction along the curves $A^2\ E^2$, and expansion along the center $a^2\ E^2$. It is not advisable to punch the rivet holes before the sheets are bent. The "Theoretical and Practical Boiler Maker," by S. Nicholls, is a good book for boiler makers.

(267) J. E. B., Brooklyn, N. Y., writes: Kindly inform me how to compute the weight which must be placed on the end of a safety valve lever to withstand any boiler pressure, the diameter of valve, length of lever, and position of fulcrum being given. *A.*—We have explained this thoroughly in answer to Question 600 in our issue of December 7, 1893. 2. Please give me the method of determining the stress in boiler braces, and their diameters, the position of the braces and the boiler pressure being known. *A.*—Let s, s, s, Fig. 1, represent the position of the braces on a given plain surface. To find the portion of this surface which any one of these braces, say s', has to support, draw the lines $a\ c$, $c\ d$, $d\ b$ and $a\ b$, midway between this brace and those nearest to it, as indicated in the sketch; if the distance between these braces is 8 inches, then the brace s' will have to support a surface of $8 \times 8 = 64$ square inches; and, if the boiler pressure is 100 pounds per square inch, then the total pressure which this brace has to resist, will be $64 \times 100 = 6{,}400$ pounds. The stress in boiler braces should not exceed 6,000 pounds per square inch of the smallest cross-section. When the brace is perpendicular to the surface which it has to support, we simply divide the pressure which it has to resist by the stress allowable per square inch; the result will be the cross sectional area of the brace. According to the foregoing, the cross sectional area of the brace which has to resist 6,400 pounds will be $\frac{6{,}400}{6{,}000} = 1.066$ square inches, the corresponding diameter is $1\frac{3}{16}$ inches nearly. If the brace has a thread on the ends, then the diameter as found above will be the diameter at the bottom of thread. For a brace which is inclined to the surface which it has to support, we first find the steam pressure which it has to resist by the preceding rule; then apply a graphical method for determining the stress per square inch of cross section of the brace. Let s, s, s, in Fig. 1, again represent the position of the braces on the boiler head; suppose now, we find that the brace s' has to support a surface of 64 square inches, and that the steam pressure is 100 pounds per square inch, then the total steam pressure which the brace has to resist will be 6,400 pounds. So far the mode of procedure is precisely the same as in the first case. Now, let i m, Fig. 2, be the center line of the brace inclined to the boiler head f h. Through the point i draw a line i l perpendicular to the boiler head f h, and upon it lay off to any convenient scale or common rule the total pressure the brace has to resist; this is done in the following manner: Suppose we decide that 1 inch is to represent 1,000 pounds; then, since the brace has to resist a pressure of 6,400 pounds, the length of i l must be 6.4 inches. Through the end l draw a line l k perpendicular to i l, meeting i k in k; the length of i k will now represent the total stress in the brace. If this length measures 8 inches, then, because we have decided that 1 inch represents 1,000 pounds, the total stress in the brace will be $1{,}000 \times 8 = 8{,}000$ pounds; and since 6,000 pounds is the allowable stress per square inch of cross-section, the area of this section will be $\frac{8{,}000}{6{,}000} = 1.33$ square inches, the corresponding diameter will be $1\frac{5}{16}$ inches nearly.

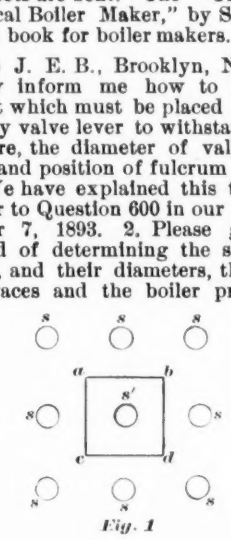

Fig. 1

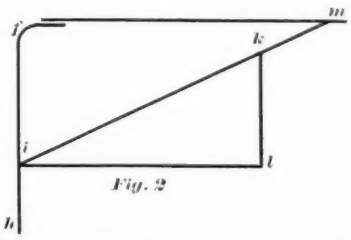

Fig. 2

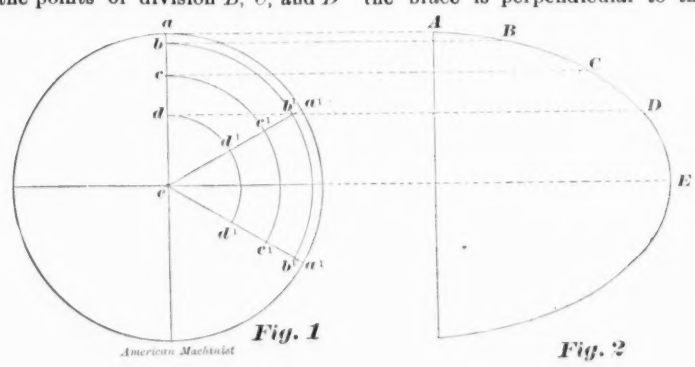

Fig. 1 Fig. 2

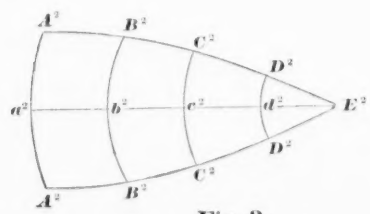

Fig. 3

Business Specials

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant's Gears, Lex'n, Mass., & Phila, Pa. See p. 12.

Forming Lathes, Mer. Mach. Tool Co., Meriden, Ct.

Milling Machs. Kempsmith Co., Milwaukee, Wis.

Turret Drills, 6 spindles. A. D. Quint, Hartford, Ct.

"National" Lathe Chucks. Best made, page 15.

Pattern and Brand Letters. A variety of sizes and styles. Heber Wells, 157 William St., N. Y.

Davis Key Seating Machines kept in stock by Manning, Maxwell & Moore, 111 Liberty St. N. Y.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt St., N.Y.

Engine Castings, 1 to 6 Horse-power Vertical. Humphrey's Foundry, Bellefontaine, O.

Cheap second-hand lathes, planers, shapers, drill presses, punch presses, etc. S. M. York, Clev'd, O.

Guild & Garrison, Brooklyn, N. Y., manufacture steam pumps, vacuum pumps, vacuum apparatus, air pumps, acid blowers, filter press pumps, etc.

Improved Duplex and Special Gear Cutters in stock and to order; Gear and Milling Cutters of all descriptions. R. M. Clough, Tolland, Conn.

"Pumping Machinery." New book, 450 pp. 8vo, 270 Eng. Prospectus free. W. M. Barr, 3223 Powelton avenue, Philadelphia, Pa.

How to run engines and boilers. Post free, $1.00. Spon & Chamberlain, 12 Cortlandt street, New York.

New Jersey Art Metal Co., Passaic, N. J., finest thin and ornamental castings in brass, bronze, aluminum, etc.; machinery name plates in brass and aluminum.

Grinders' Supplies—Emery, Emery Wheels, Grinders, Knife Powders and Sharpeners, Paste & Liquid Polish, Whetstones. The Tanite Co., New York, N. Y.; Cincinnati, O., & Stroudsburg, Pa.

"Binders" for the AMERICAN MACHINIST. Two styles, the "Common Sense," as heretofore sold by us and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING Co., 203 Broadway, New York.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 post paid. Published by John Wiley & Sons, 53 East Tenth street, New York.

Russian Factory Hands.

An article which we find in the *Evening Post* under the above title will, we think, prove quite interesting to American mechanics.

In this connection it is interesting to remember that among the finest if not absolutely the finest art iron castings are those made in Russia, some very beautiful specimens being shown at Chicago. The article referred to is as follows:

In Russia, which is an agricultural country, the great and small manufactories take their workmen from among the rural population. For the greater part, workmen in Russian factories are at the same time landowners, who are not factory workmen by

profession. The wages they earn in factories are not their only means of existence, but are only accessory to what they get by their agricultural labors. The workman loves his land, and does not like to leave it permanently for the factory; he has, therefore, continual intercourse with his village, and goes there yearly to see his relatives, and, still more, to cultivate his little farm. Therefore the life of the Russian workman is quite different from that of the Russian abroad. Thus, having his own land, he is more independent in signing a contract with his master, and can demand higher wages than if he had no land and no home. He does not always take advantage of this circumstance. Nevertheless, he always has in view that, in case of failure, he can always return to his village, where he will get board and lodging. This is the reason why, in the manufacturing localities of central Russia, the wages change regularly twice a year; in spring and summer they are 10 to 20 per cent. higher than in autumn and winter. This occurs because in spring many work men return to their villages for field labor, and hands become scarce in factories. This fact also determines the term of service. In the central governments the workmen are generally hired from October 1st to Easter, when field work begins, or from Easter to October 1st, when all field work is ended.

Being an agriculturist by nature, and considering farm work to be the principal kind of labor, the Russian workman seldom tries to perfect himself in any other industry, and seldom chooses other occupations. This fact, of course, has a bad effect on his earnings, but, on the other hand, in case of need, he finds a place much more easily in some factory than if he knew only one special industry; especially as, having great natural capacity, he easily adapts himself to any industry. An Englishman who had had many workmen under him, both in England and Russia, once declared that a Russian workman would learn as much of a new trade in three months as an Englishman would learn in three years. Thus, the Russian workman frequently works first at one factory, then at another, when the two have nothing in common.

The Russian workman spends very little of his earnings in food, lodging, and dress, as compared with the workmen of other countries. His demands are very modest. His food is very simple, though abundant, and suits his tastes. It consists of stchi (cabbage soup), meat, hulled buckwheat boiled into thick gruel, with linseed oil, for dinner and supper; for breakfast, tea and sour black rye bread. On fast days, which are many, he eats fish, mushrooms and vegetables, instead of meat. His principal and favorite beverage is kvas, small beer brewed from the sour black bread, or direct from rye meal. As in many factories tea and sugar are furnished by the proprietors, the workman's food becomes still less expensive. The factory owners get these articles in large quantities, and buy them very cheap and of a fair quality.

In Moscow, for example, a workman's board comes to about $2.25 to $3.50 a month, or from $27 to $30 a year. But for the most part, both in towns and villages, the workmen board at their own expense. In order to reduce the cost, they form associations or clubs, called artels, and board together. An artel is generally formed either of workmen from the same village or from the same factory section; they choose a chief among themselves, who has to arrange all the affairs of the club. They also appoint several members to control the chief, called the starosta. The starosta buys all the provisions, engages a cook, keeps the accounts, and calculates what each member of the artel is to pay. The accounts are then presented to the administration of the factory, which pays them out of the earnings of the workmen. The administration furnishes the artel with a kitchen, fuel, water and an eating-room free, all which cost the factory about one cent for each person. Thus the workmen receive cheap and good food. The boarding expenses are not uniform, and depend largely upon what the workmen in each artel earn. There are workmen who earn $30 a month, which permits them to indulge in more dainty food; but even then their board does not cost more than $3.50 to $4 a month each. In many factories there are provision shops kept by societies formed of the workmen themselves. In such shops the workmen not only get all provisions at market price, but also a dividend of from 3 to 6 per cent. Unfortunately there are very few such shops.

The Russian workman is usually well lodged. In nearly all large factories there are buildings specially constructed for him. Here he gets lodging, fuel, and light, sometimes free, or at a very low price, according to circumstances. The first type of these buildings resembles barracks. In enormous buildings, many stories high, large, light, well ventilated halls contain hammocks or bedsteads, with mattresses and pillows filled with straw. Married men, bachelors, girls, and widows sleep in separate halls. There is a general kitchen and dining-room in the building. The second type of building consists of lodgings, sets of small rooms for families of from three to five members. The workmen eat in their own rooms; there is a kitchen in each story, containing an enormous stove, which extends through all the stories, and has many sections. A great kettle, for boiling water for tea and so forth, is also provided. The workmen furnish and light their own rooms The factory only lights the staircase, corridors and kitchens, and heats the house.

The third type of house, the one most in favor with the workmen, but, unfortunately, not much developed in Russia, consists of separate small wooden or stone houses, containing from two to four lodgings each, with separate staircases. Each house has a small yard, necessary outbuildings, a garden, and a kitchen garden. The prices of lodgings vary greatly. Those in buildings of the first type are much cheaper. In general lodging and fuel cost a workman from 25 cents to $1.50 a month, or from $3 to $18 a year. Above everything the Russian workman prizes a lodging provided by his master. Such lodgings are not only cheaper, but their price does not fluctuate, as is the case with private lodgings, and he does not have to buy wood, a consideration of great importance in a country where the winter is so long and cold. Private lodgings are mostly in a very bad sanitary condition. Consequently, of two factories, one of which has lodgings for the men and the other has none, the workmen will generally prefer to serve in the former. Russian manufacturers know this, and try to provide good lodgings, for the sake of securing good workmen.

Moreover, every large factory situated out of town has a hospital as required by the law; a bath, a school, a library with reading-room; and some very well-organized factories have, besides, almshouses for aged workmen and for babies, infant schools and other charitable institutions.

The most general manner of payment is by the piece, as stated in the contract, the time for the fulfillment of the work being fixed by the workman, in agreement with the regulations of the factory, or he is paid for time work, according to his ability. In a few factories, such as machine shops, wages are paid to a whole artel or guild, after a certain amount of work is completed. Formerly the workmen always received daily or monthly wages, but that method is now practiced where the payment by the piece cannot be adopted.

Formerly the workman was liable to ill treatment on the part of the manufacturers. His wages were paid at indefinite intervals, and he had to wait months sometimes for them, and had to borrow money at high interest to live upon meanwhile, or fall in debt. Part of his wages was also often withheld on various pretexts, or wages were arbitrarily lowered before the expiration of contract time, by diminishing the hours of labor and the pay in proportion, and so forth.

All such arbitrary methods and misusages were stopped by a special law in 1886, entitled "The mutual relation of the manufacturers and their workmen, and the inspection of different works and manufactories." It is a humane law, which shows the solicitude of the government for the welfare of the working classes. It defines clearly and precisely the mutual relations between employers and workmen, and appoints special boards of control to see that these relations are fulfilled. Among the provisions of the law is one which compels the employer to give his workman a written contract, with every particular clearly set forth: term of service, amount of wages, times and mode of payment, price of lodging, amounts and causes of fines which may be imposed, and all other details of the contract. The book, of a prescribed pattern, in which these points must be inscribed contains also extracts of the law, and regulations concerning the rights, duties, and responsibilities of the workman, which, by law, must be composed by the administration of the factory and approved by the local inspector. This book, which the workman himself must keep, contains, among other things, a separate description for adult workmen and children of the hours when the work is to begin and finish; how often and how long the men may interrupt their work to rest, lunch, and dine; the hour for stopping work on Saturdays and the eves of holy days, on what holidays they do no work, and so forth. The manufacturer is forced to present to the Board of Inspection a detailed valuation of the workman's labor, and these lists must be hung up in the workshops. It is, moreover, strictly forbidden to lessen the workman's wages by issuing a new list of wages, or by decreasing the days or hours of labor, or by any other means, before the term of the workman is up, or without a fortnight's notice if he be hired without a definite term. It is also strictly forbidden to pay the men in coupons, bread, wares, or anything else instead of money. This clause existed in a former statute, but has now been confirmed in greater detail, and the penalty for breaking this law has been made more severe.

Shops cannot be established without the permission of the factory inspector, and the price lists, after approval by the inspector, must be exhibited at the shop, for the information of the workmen. Special penalties are imposed for the breach of these and of other regulations.

The law establishes factory councils, which have the right to impose fines not exceeding $50 for the breach of regulations, to make regulations concerning measures to be taken for guarding the life, health, and morals of the workmen, and for medical aid, these regulations having all the force of law. Each factory council consists of the chief of the government, who is the president; the local factory inspector, the procurator of the court of justice, the chief of the gendarmes, and two representatives from the factory. The medical inspector of the government, the government engineer, architect, and mechanic, and other persons from whom useful information and explanations on the matter in hand may be derived, can also take part in the sessions of the factory councils.

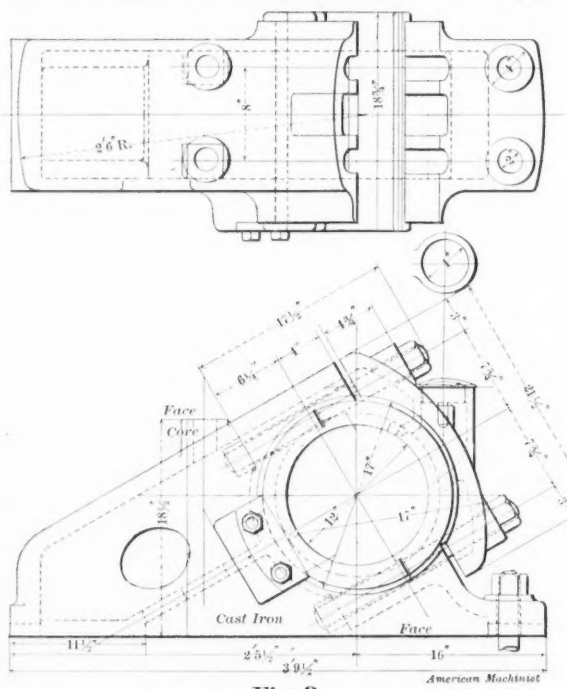

Fig. 3

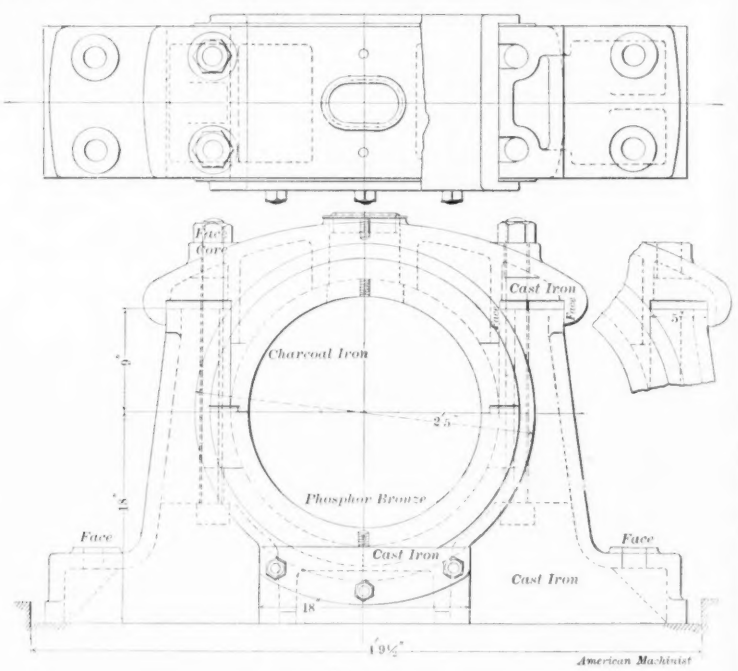

Fig. 4

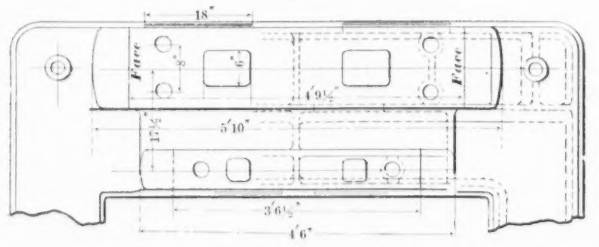

Fig. 5

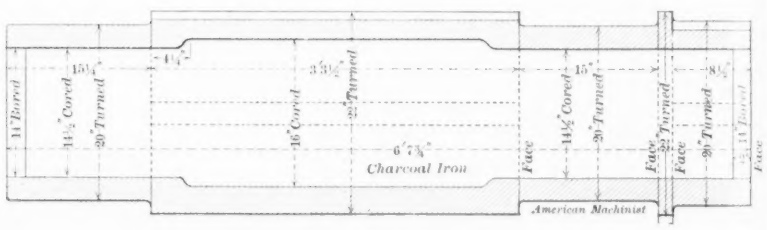

Fig. 6

CABLE-DRIVING MACHINERY (See page 11).

About ten years ago Russian manufacturers had the right to make their work-people of all ages, and of both sexes, work all the year round, not excepting Sundays and holidays, and at all hours of the day and night. Children six or seven years old, young lads, girls, and women, all work as much and as long as the men. In 1882 a law was published (which was perfected in 1884 and 1890) which absolutely prohibited the employment of children under twelve in factories. Children from twelve to fifteen years of age are allowed to work only in the daytime, and then not more than eight hours, with an hour for rest after four hours of work, or else six hours without rest.

An Improvement in Cable-driving Machinery—II.

By M. W. SEWALL.

The rope gear is probably the least likely to accident of any part of the plant, therefore if any of the shaft connections are to be plate couplings, those connecting the drum shafts 1 and 2 at the center should be such. This would, however, prevent making combination 3 or 4 without stoppage of the cable. The whole number of combinations as given are eight, and it is doubtful to my mind if it be judicious to throw out four of these to save two clutches. The central connection on shaft 1 should be a friction clutch in case of their being used next the engines.

In a cable plant where but one set of machinery and one cable are in use, this system will be found of great value from the fact that should one set of the rope drive need immediate repair from any cause, it may be thrown out of use entirely and that without stopping, and the traffic be carried on by driving the cable by one drum, and allowing the other to run idle. In this case, the ropes of the working drum would be strained more heavily, but the factor of safety is so large that this could be done for a short time without detriment. I know of no existing plant where this can be accomplished. A rope drive is not essential to this system; a slight modification will adapt it to toothed gearing and a plant equally elastic as to its interchangeability may be obtained.

It will be observed from this description that, as has been mentioned, the central shafts are in no case subject to stresses other than those of torsion, and that the shafts carrying the heavy drums are short and of large diameters, and consequently very stiff. No deflection will occur in them that is likely to affect the journals. The central shafts may have comparatively small bearings, as they carry their own weight only. The bearings for the latter are shown at l and k, Fig. 1, and those of the former at d and g. The shafts are designed by the formula $T = f Z_t$; for solid cylinders $Z_t = 0.196d^3$, d being the diameter. The horizontal engine and connected gearing shown in general plan (Fig. 1) are for the purpose of turning the winding machinery for the inspection of cables and for running in new ones. The gear wheels are inside the 10-foot pinions, and the toothed pinions slide on their shaft to throw out of gear. A vertical two-cylinder reversing engine should be used in place of a single cylinder engine, as shown.

There is one feature that should not be neglected, and that is the extension of the cable shaft through its outboard bearing. This gives a peculiar appearance to the plant, but when the use is made known, I think it will be justified. With a short drum shaft the outer bearings with a strut between them, as used in the plants built by The Robert Poole & Son Co., in which the cable drums are overhung, is not possible, but an outboard bearing is necessary. The extension shafts are for the purpose of using a jack for raising the shaft, and sliding the pillow block out far enough to remove an old cable and put in a new one.

By reference to Fig. 1, it will be seen that continuous bed-plates have been used where possible in preference to isolated base pieces for pillow blocks.

The cable drum shaft pillow blocks are shown in Fig. 3; those for the rope drum shaft, in Fig. 4; those for the center shafts are of the same design as the latter. I wish to call special attention to the fact that the brasses in all cases are simply bushings fitted accurately into turned seats in their supports; so that there are no large ribbed surfaces, but the brasses are in all cases well backed up by solid metal. It would appear that plants that have very large bearings and yet have trouble in this direction are the result of careless design. There are plants having small bearings, in fact, so small that they wear rapidly, that run cool, but it will be found that their brasses are thoroughly backed up, and do not consist of a shell supported by ribs. The circular form of the outside of these brasses gives a means of removing them for examination or repair by raising the shaft only enough to free them, when they may be turned up out of place and removed. They are prevented from turning when in use, by a key-plate bolted against the side of the pillow block, and properly fitted against the brass.

Considerable time has been spent in an effort to design this work so that the bolts, both those for holding down the pillow blocks and the cap bolts, could be removed easily and replaced should necessity require. The drawings show clearly that this has been accomplished. Figs. 3 and 4, if taken in connection with the base plate drawings, Fig. 5, will make this clear; which last shows in plan the footing for pillow block shown in Fig. 4. The rectangular holes between the bolt holes are for passing down the cap bolts—large openings in the sides of the base-plate allow all of the bolts to be removed through them. One of the hollow drum shafts is shown in detail in Fig. 6.

The cable drum, Fig. 8, was designed with a removable grooved rim that can easily be replaced when worn. The center is made in halves, and with hollow arms; its rim has a faced groove in its center to receive a tongue on the removable rim. See Fig. 7*a*. The grooved rim is also made in halves, and they break joints when assembled with the center; twelve 1½-inch tap bolts passing radially through slots in the center rim, and tapped into the outer rim, secure the parts of the drum. Four 1¼-inch shear pins are driven into reamed holes through the lapping parts of both rims to prevent any possibility of movement of the separate parts of the drum in case the tap bolts should get loose. These pins are shown in section 7*a*.

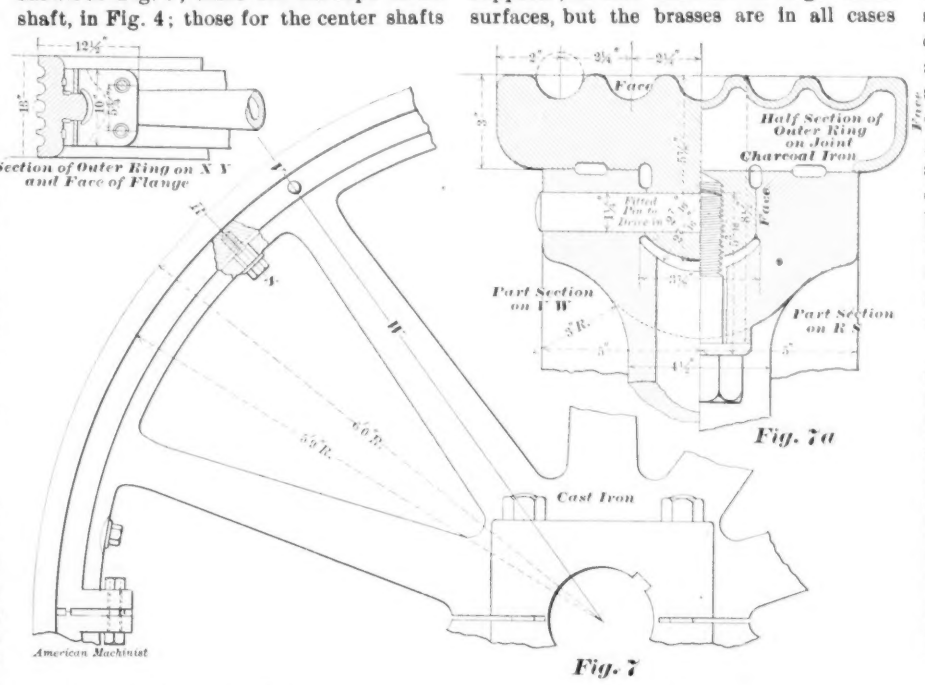

Fig. 7

Fig. 7*a*

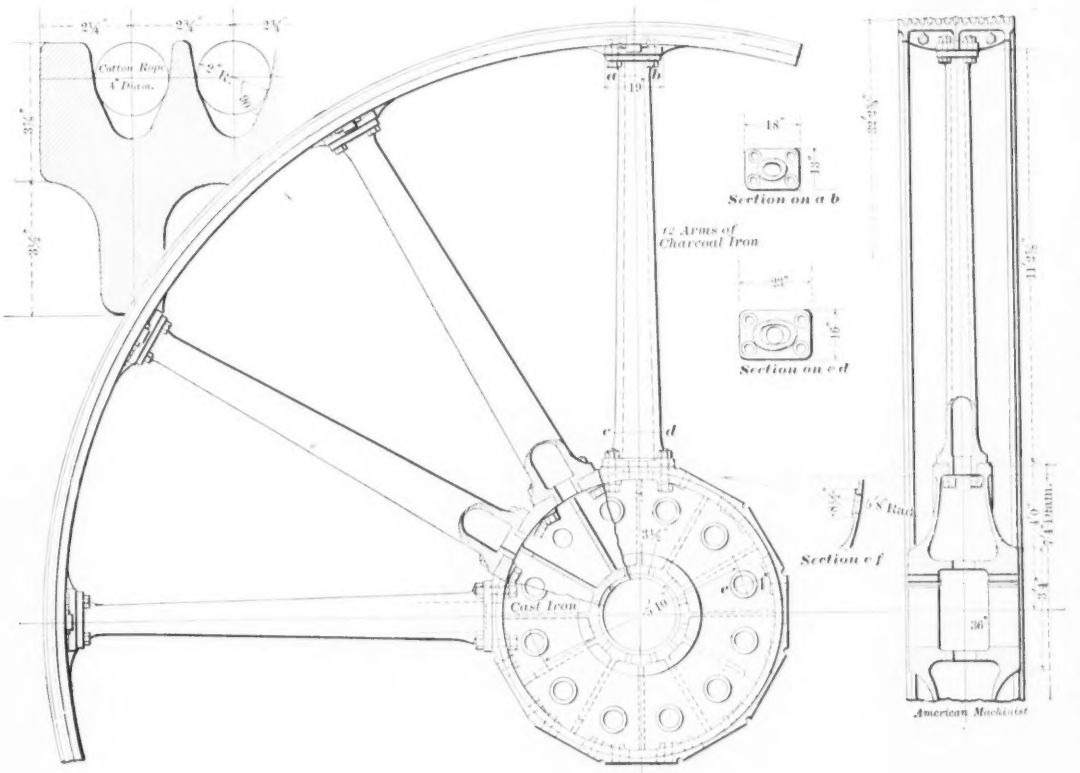

Fig. 9

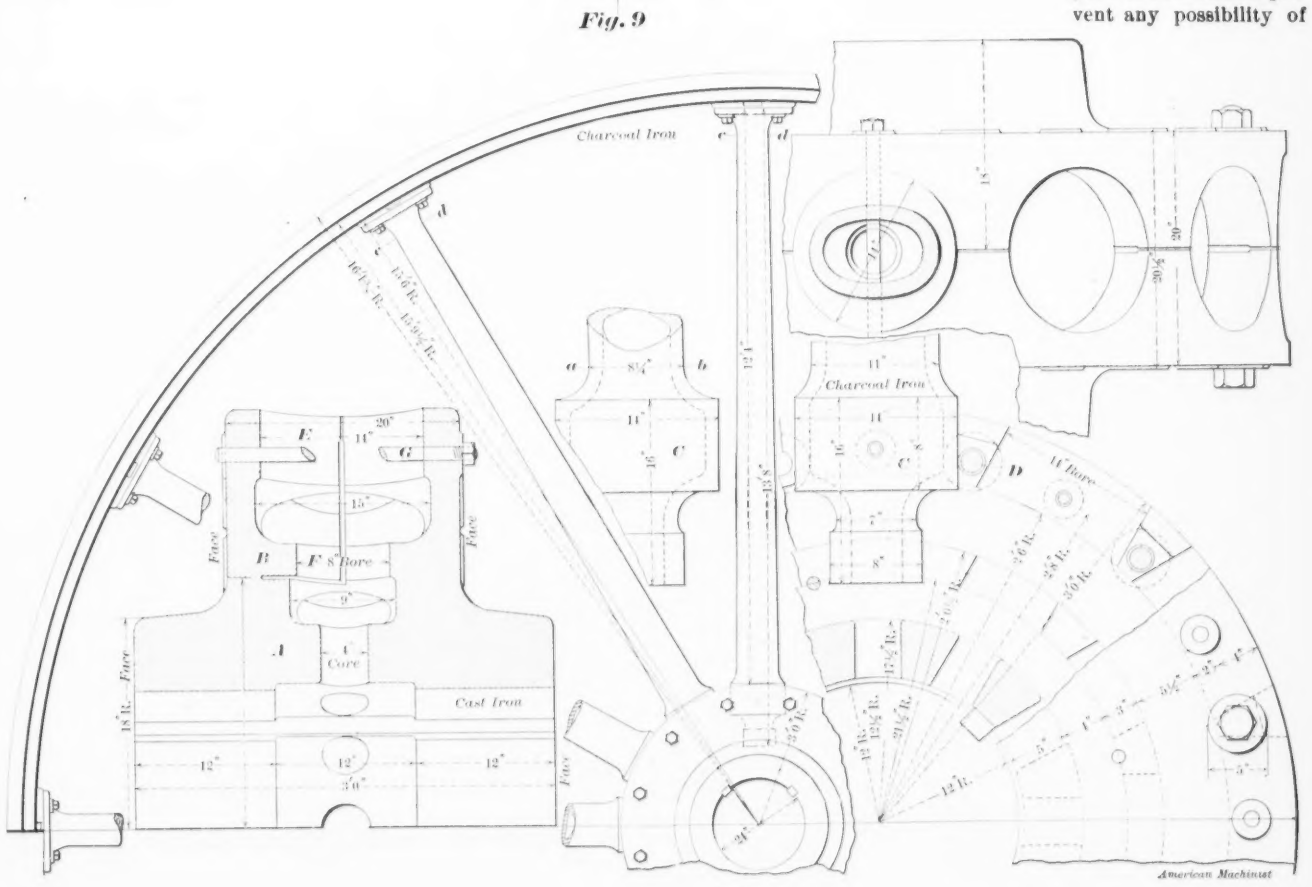

Fig. 8

CABLE DRIVING MACHINERY.

Fig. 8 shows the 32-foot rope wheel as at first designed. This wheel was afterwards re-designed, as per Fig. 9, to suit the contractor for the work. The writer, however, believes the original design to be much superior. It will be seen by reference to Fig. 8 that the arms of the drum are secured to the center by clamping two turned portions on the inner end of each arm between heavy cast iron disks, one of which is cast as a flange on the hub, and the other acts as a follower. These are bolted up a slight distance apart, and the holes for the arms are bored accurately to fit the turned portions of the same. The bolts are then loosened, the arms put in place and the follower bolted hard up to the hub flange. A taper pin is then driven into a reamed hole through each arm and the parts of the center, and held in place by a nut. The arms and the center are then practically one piece, and no working of the parts among themselves is possible. None of the bolts secure an individual arm, and no stress transmitted to the center through the arms brings any of them into direct tension; several bolts might be broken without detriment to the structure. This drum would be improved so far as convenience of manufacture is concerned by a shoulder on the arm to determine its distance from the center when assembling in the shop. The arms are attached to the rim in the usual manner. The drum as re-designed, see Fig. 9, has arms with flanges bolted to the center, all stresses transmitted to the center are resisted by bolts in direct tension and flanges under breaking stresses, so that should any one of these numerous parts break some other would be unduly strained and disaster might follow. A working of the parts is also possible with such a design, especially if some are slightly sprung in assembling, as they may be. The proportion of the arms in the second design is better than in the first, in which they were too light.

There are no special features in the other details of this plant. It has been the effort of the designer to produce a plant that in all its parts should show plain and substantial work, with parts easily kept clean and with no protruding corners or unsightly dirt pockets.

To prevent any misunderstanding it should here be stated that this is not a description of the machinery for the Broadway road as built. The designs were accepted by the chief engineer, and the contracts made with the expectation of their being followed. For reasons other than mechanical ones, the details were very much changed after the contracts were closed, and the plant made much less flexible than is here shown.

A. H. Nelsen, Knoxville, Tenn , would like the party who recently inquired about making hollow brass balls to favor him with his address.

How a Trolley Car Really Works.

The following has been published as a *bona fide* explanation of the action of a trolley car by a man who professed to know all about such matters, given for the benefit of his friend who had never studied into the matter. They were standing near a trolley car and the electrician said :

"You see that little copper wheel on top of the pole, that runs along pressing against the wire; well, that's what makes the electricity. That was the invention. The pole from the car-roof with the copper wheel on the end of it is what they call the carbon. Now, some fellow discovered that such a wheel on the end of the carbon, running against a steel wire, created the electricity. The faster that copper wheel revolves the more electricity it makes and the faster the car goes. That's the reason the little copper wheel is made so small. Then the extra power, more than is necessary to keep the car going, you know, is accumulated in those things at each end of the car, and when the driver wants to start her up he just turns his crank and lets out enough electricity to start her ; then the copper wheel on top of the carbon starts generating, and so on it goes. Great invention, sir ; great invention!"

This man is undoubtedly one of the many who are always ready to affirm that there can be no doubt that electricity is going to supplant the steam engine.

The office of *Poor's Manual* has been removed to 44 Broad street, New York.

MANUFACTURES

The American Electric Company is a new $10,000 concern at Toledo, O.

A new electric-light plant is shortly to be established at Crookston, N. D.

John D. Pitts will rebuild his burned saw-mill plant at Glen Alpine, N C.

An electric street railway system between Covington and Erlanger, Ky., is being talked of.

An electric-lighting system will probably be established by the citizens of Flatbush, N. Y.

The Muncie Iron and Steel Company started their new merchant mill at Muncie, Ind., this week.

The New Bedford (Mass.) Boiler and Machine Company will erect a new building at its plant.

The annual vacation of the American Waltham (Mass.) Watch Company will begin on June 20th.

The Atlas Engine Works, Indianapolis, Ind., recently shipped ten car loads of engines from their works.

An increase of capacity and other improvements will be made in the electric street-lighting system of Benwood, W. Va.

A $95,000 stock company may establish a 100-ton cotton seed oil-mill at San Antonio, Tex. W. E. Miller is secretary of the company.

The Receiver expects to put in operation the plant of the West Superior Iron and Steel Company, at West Superior, Wis.

Better trade warrants the Pennsylvania Iron and Coal Company Canal, Dover, O., making considerable improvement in their blast furnace.

It is said that a new steel company will be organized to utilize the old buildings of the Kelly Axe Manufacturing Co., Louisville, Ky.

The Detroit Twist Drill and Chuck Co. write us that they have recently filled a large order for twist drills and chucks that are to go to Africa.

Boston Gear Works, Boston, Mass., is sending out their 1894 catalogue of regular and irregular gearing, chain wheels, driving chain and various other specialties.

The Union Rolling Mill Co., of Cleveland, O., which closed recently on account of scarcity of orders, has received an order for 250 tons of iron, and the mills are again in operation.

Horace See, No. 1 Broadway, New York, issues an illustrated circular of the Yarrow boiler; also of the See hydro-pneumatic ash ejector, by the use of which ashes are discharged at least 20 feet clear of the vessel.

Link Belt Machinery Co., Chicago, Ill., and Link Belt Engineering Co., Philadelphia and New York, have issued a special catalogue relating more especially to mining machinery. It will be of interest to all who have to do with such machinery.

Beaman & Smith, Providence, R. I., have issued a neat little catalogue illustrating and describing the line of machine tools made at the works. This concern, which is comparatively young, already manufacture quite a line of tools, to which they are constantly adding.

The Meteor Bicycle Manufacturing Company, a new institution with a capital of $50,000, started a business at Battle Creek, Mich., with a force of 20 employes. The firm has orders for more than it can make in the next three months. It expects to have 100 employes at work inside of 30 days.

Edwin Harrington, Son & Co (Inc.,) Philadelphia, Pa., have issued a "booklet" which they are glad to send to those who are interested in handling dynamos, generators, motors and general heavy machinery. It illustrates cranes, chain hoists, turn-tables, etc., of their system for handling such work.

There are prospects of a large cotton-mill being erected at Nesbitts, on the Tyger River in South Carolina. It is stated that by development the river will afford 1,000 horse-power. Some 25,000

VACUUM REGULATOR.

We recently manufactured for a large sugar refinery, a new regulator to automatically maintain a certain vacuum in the kettles. By attaching one of these to the exhaust pipe of each kettle, you can maintain on each one a different vacuum, and use the same pump for the series. Prices on application.

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By R. H. THURSTON,
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Ready Made Cut Gears.
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Gear Cutting Machines.
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42-INCH SWING, WITH TURRET HEAD, AND SCREW CUTTING ATTACHMENT.
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Machines are self-contained and therefore do not require an expensive foundation.
BRIDGEPORT MACHINE TOOL WORKS,
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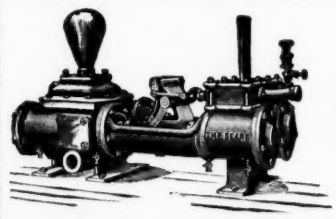
New York Office, 86 LIBERTY STREET.



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SAVES LABOR in being able to run at GREATLY INCREASED SPEEDS. FEWER GRINDINGS. No WASTE in redressing.
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We are building them in various sizes from 10 inch to 24 inch swing, in various lengths, both engine and speed lathes. Our designs are the latest and most approved, while the workmanship, material and finish are of the highest order. Our catalogue will tell you all about them, as well as of our planers, shapers, drills and other tools and supplies. A postal will bring it. Write us for prices.
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spindles would be operated in the mill at the outset. H. D. Wheat, superintendent of the Gaffney (S. C) Mill, is actively interested in the enterprise.

Gisholt Machine Company, Madison, Wis., has issued the first of a monthly series of pamphlets on turret-lathe practice, which is intended to illustrate the more common uses to which their class of turret machinery is adapted. The present number contains illustrations of turning plate couplings, making screws, turning Corliss engine bonnets and making shoulder studs.

The Electrical Association (incorporated), of Waterbury, Conn., have placed the contract for their new power station with The Berlin Iron Bridge Co., of East Berlin, Conn. The building will be 66 feet in width and 183 feet in length, the side walls of brick and the roof covered with The Berlin Iron Bridge Company's patent anti condensation corrugated iron roof covering.

Wiley & Russell Manufacturing Company, Greenfield, Mass., have brought out a new screw plate, taps, etc., which will undoubtedly be found a convenience by repairers of bicycles. Instead of the different sizes being by fractions of an inch, or screw-gauge sizes, they are Birmingham (Stubbs) wire-gauge sizes. Others as well as bicycle repairers will be interested in this new screw plate.

Numerous press dispatches, of which the following is a sample, show the influence of the coal strike on manufacture: "For the first time in 12 years the mills of the Mahoning Valley Iron Co. are idle. The shut-down is occasioned by the fuel famine. The company has plenty of orders, but not a pound of coal. All departments of the Union Iron and Steel Co.'s lower mills, except the bar and guide mills, are idle through lack of fuel."

The Lodge & Shipley Machine Tool Co., of Cincinnati, O., recently made a test of their 30-inch double saddle turret lathe, turning the diameter, squaring down the rims on both sides, and boring a cast steel blank 23 inches diameter, 4½ inch face, 3⅜-inch bore, hub 7½ inches long, in 45 minutes, including the time from picking up the piece to laying it down finished. This, they believe, is a good day's work for a powerful engine lathe. This machine is guaranteed to turn out ten such pieces in ten hours.

Weston Engine Co., Painted Post, N. Y., has issued a finely illustrated catalogue of the Weston automatic engine, the illustrations embracing views of the engine entire, sections, and separate views of important details. There are engravings showing the foundation, lettered and tabulated in such a way that all dimensions for the various sizes of engines, and the number of brick required can be seen at a glance. A table of horse-power constants is also appended as well as a formula for calculating horse-power.

Cleveland Twist Drill Company, Cleveland, O., have received the following, unsolicited, from a customer: "The drills which you have furnished us are the best I know of. I have drilled two holes in a 66-pound steel rail with two men in exactly four minutes. They very often have drilled 100 holes without being sharpened, and I have one instance of 120 holes by accurate count without sharpening the drill. We will say in connection with the remarks as to the two men drilling the rail, that these drills were used in one of the well-known makes of track drills which are run by hand-power."

The Wright & Secord Machinery Company is the name of a new concern started at Indianapolis, Ind., to manufacture engines, boilers, shafting, etc., having leased the buildings on South Pennsylvania street, formerly occupied by the National Bicycle Company. Mr. Wright was foreman at the Eagle Machine Works, and Mr. Secord at the head of a department, and they start up with 20 men who were employed at the Eagle Machine Works before its financial trouble. The new firm is in much the same field that the Eagle Machine Works was in and is now quite busy. The company expects to increase its force largely as business improves.

The Abendroth & Root Mfg. Co., 28 Cliff street, New York, has issued "Information Pamphlet No. 3," which is considerably more than a catalogue, inasmuch as in addition to illustrating and describing the Root water-tube boiler, the writer goes to considerable length into the discussion of engineering questions connected with boiler construction. The features of constructive detail peculiar to the Root boiler are very completely illustrated and described. Altogether this information pamphlet, of nearly 100 pages standard catalogue size, shows in its preparation a great deal of work, and it is sufficiently aggressive in its character to make of it interesting reading for engineers and mechanics.

Beaman & Smith, Providence, R. I., have recently finished a double-head milling machine for machining the edges of steel plates up to 10 inches in thickness and 10 feet square. The *Providence Journal* says of this machine: "In general design the machine consists of two beds about 16 feet long by 2½ feet wide, set parallel with each other, and about 10 feet apart, securely braced and tied by girt frames. The two platens are set at right angles with beds, with their ends resting on the beds. The platens carry the spindle-head saddles, which, in turn, hold the spindle-heads with spindles. The movement of the spindle-head saddles on platens is about 11 feet, and is by hand or power, with quick power movement in either direction, about 20 feet per minute. A very simple safety device prevents the regular feed mechanism and quick power mechanism from being thrown in at the same time, otherwise a careless employe might seriously damage a very expensive machine. A suitable clamp frame is provided on each platen to securely fasten the work that it may be held rigidly while being machined. In the center of the machine is placed an eight-ton hydraulic lift. The turn-table on top of the hydraulic plunger is supported on ¾-inch hardened steel balls. The lift is operated from a pump worked by hand at the front of the machine. In operation the work to be milled is placed with its edges resting on the two platens (the platens having previously been adjusted to the required distance apart), clamps are tightened on the work, and the cutters are brought to the proper position by a fine independent adjustment on each head. The feed is started, and by automatic stops it is thrown out when the edges have been milled. Power, quick return, is thrown in, and the heads return ready for the next cut, the clamps are removed, the work is raised by hydraulic lift, and turned one-quarter around and lowered again to the platen, clamped, and the operation is repeated as on previous edges. A reservoir for oil, or soda water, drips liquid on the teeth of the cutter, which through passages is returned to a common receptacle to be used again. This machine occupies a floor space of about 18x22 feet. All details are heavy, and seem amply strong for the maximum amount of duty. The complete machine weighs about 48,000 pounds."

Machinists' Supplies and Iron.

NEW YORK, May 23, 1894.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $12.50 to $13.25; No. 2, $11.50 to $12.25; Gray Forge, $10.75 to $11.00. Southern brands are quoted at $11 50 to $12.25 for No. 1 Foundry; $10.50 to $11.00 for No. 2, and $10.00 to $10.25 for No. 3.

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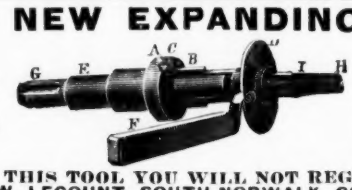

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3	1½ " 2 "	18
4 (with screws)	2 " 3 "	32
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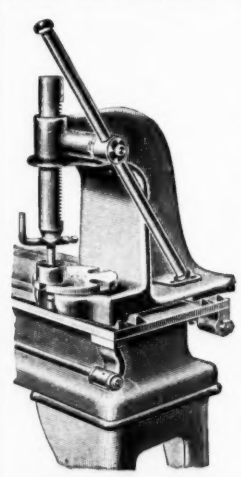

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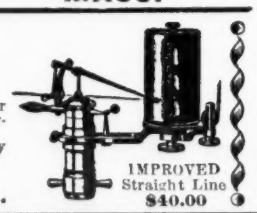
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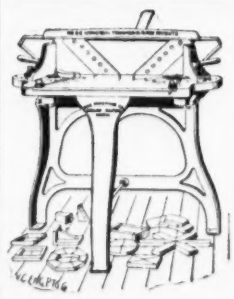

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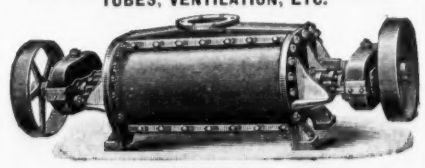

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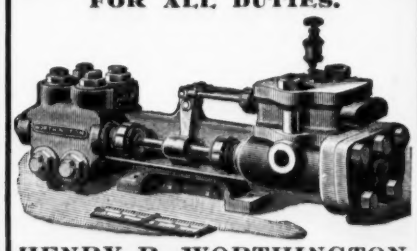

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Lard Oil—Prime is quoted at 60c. to 61c.

Copper—The market is more active, but without any marked change in prices. Lake Copper is quoted at 9⅜c. Casting Copper is held at 8.85c. to 9c.

Lead—The market is weak, some sales having been made at 3.32½c., probably from refiners, who, it is said, desire to establish lower values for the sake of making some favorable contracts for raw material.

Spelter—The market is dull; prices are nominal at 3.45c. to 3.50c. for New York delivery.

Tin—The market is quiet, the jobbing movement is slow with prices favoring holders. Sales have been made at 19.90c. to 20c.

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Mech. draft'n, 4 y'rs exp., tech. educat'n, wants position after June 1st. P. D. Q., AM. MACHINIST.

Draftsman, designer, with practical shop exp., age 25, desires position. O. K., AM. MACHINIST.

Wanted—Two skillful, first-class general machinists. Apply 115 Plymouth St., Jersey City, N. J.

Young man, age, 22, wants position in machine shop where he can learn the trade. Address E. B. Ludwig, Sabetha, Kan.

Wanted—A first-class patternmaker on machine tool-work for about six months. Address Jones & Lamson Machine Co., Springfield, Vermont.

Wanted—Position by a draftsman, experienced in coal mining, rolling mill, steel work and general machinery. BOX 44, AMERICAN MACHINIST.

Open for Engagement—Specialty, inventing and perfecting mechanical devices and special machines. Inventor, Box 1096, New Haven, Conn.

A1 machinist wants situation; vise or floor work; five years' experience in erecting and repair work. Address W., AMERICAN MACHINIST.

Wanted--A position as foundry foreman, by a practical mechanic of large experience in all branches of foundry work; strictly temperate; A1 references. Mechanic, care of AM. MACHINIST.

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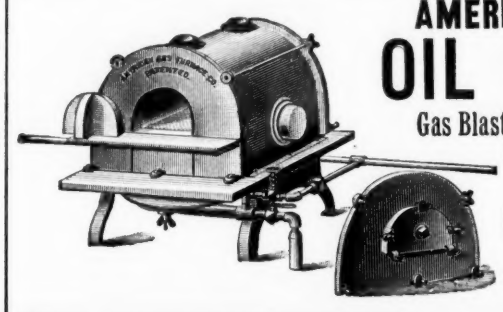

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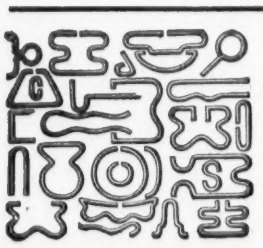

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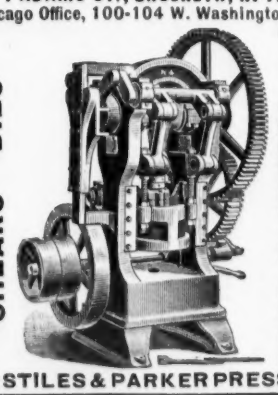

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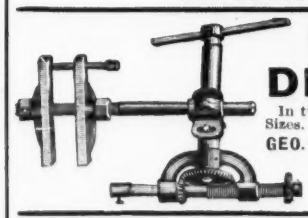

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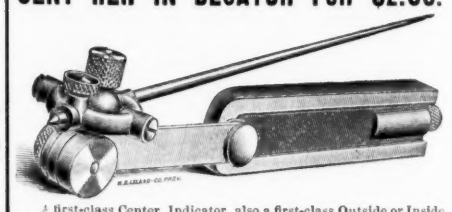

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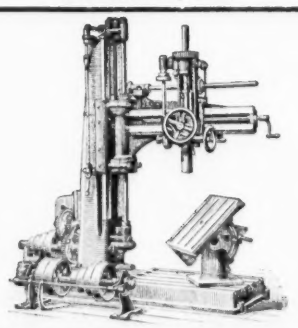

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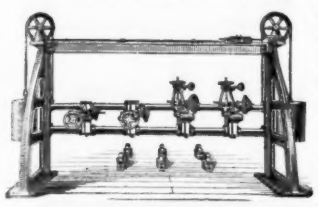

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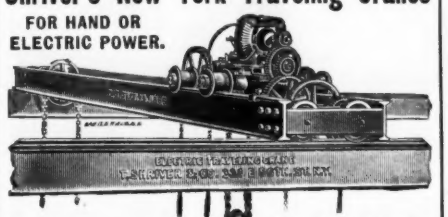

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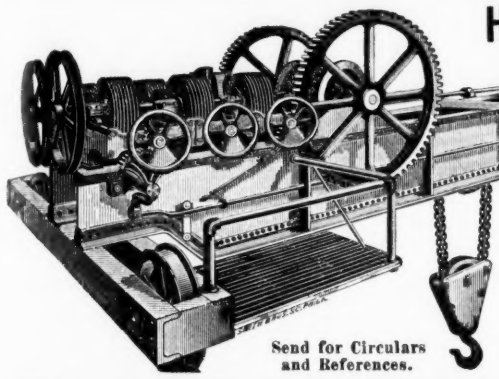

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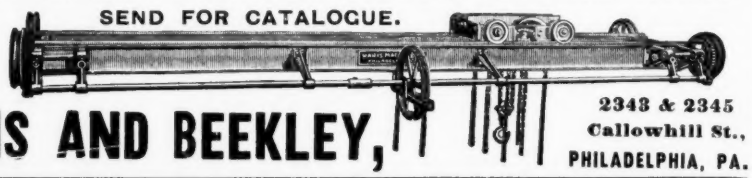

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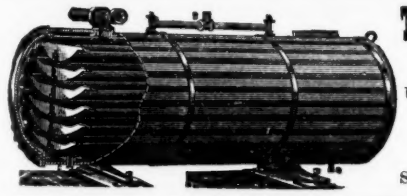

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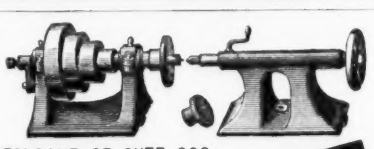

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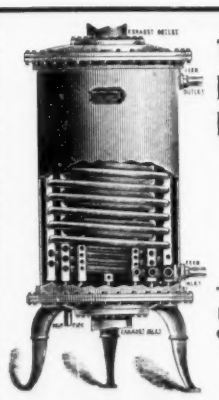

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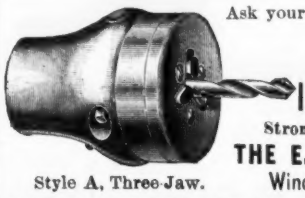

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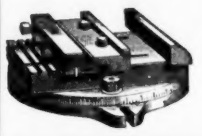

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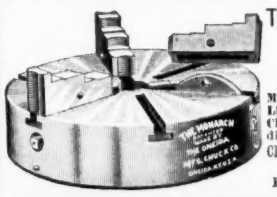

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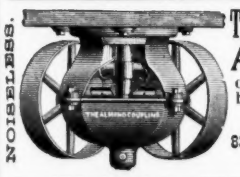

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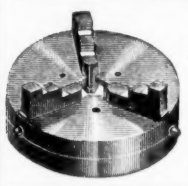

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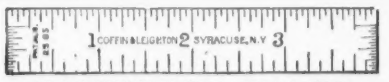

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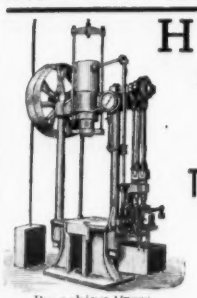
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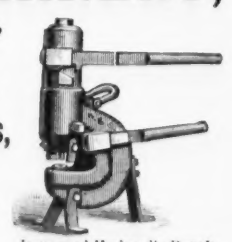
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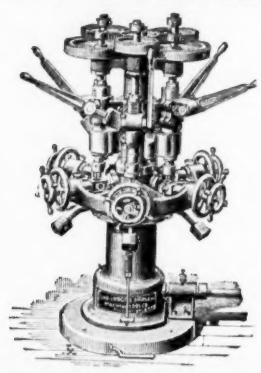

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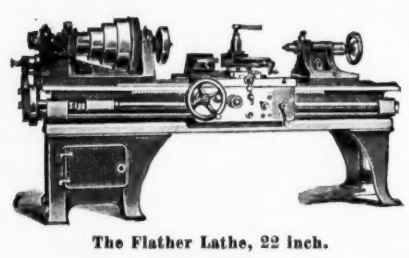

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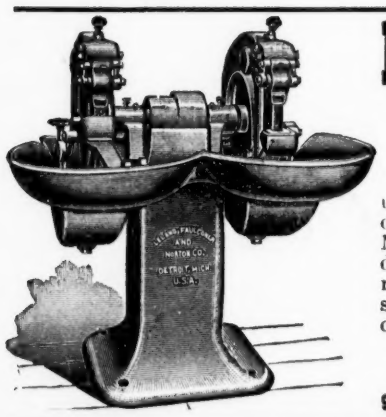

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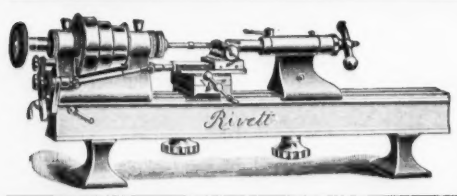

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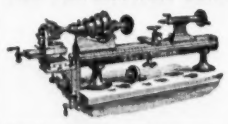

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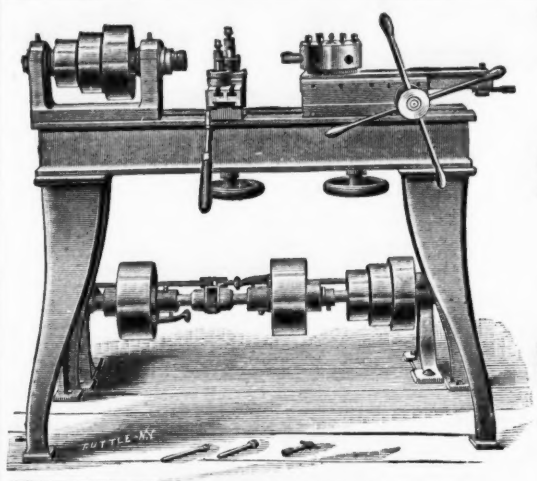

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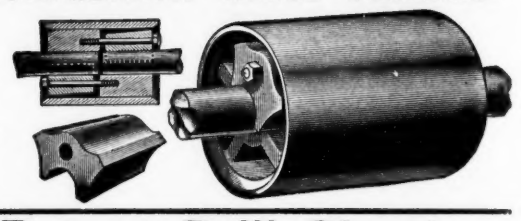

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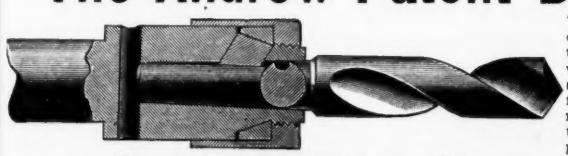

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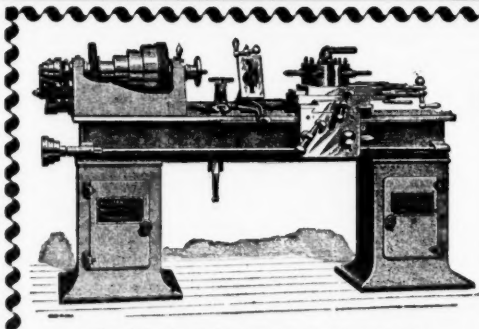

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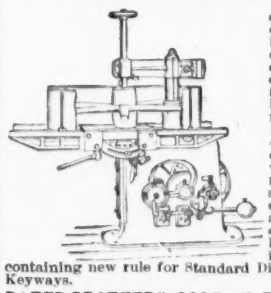

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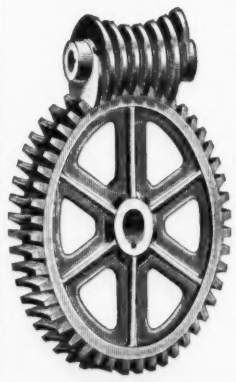

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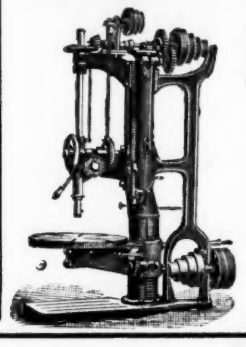

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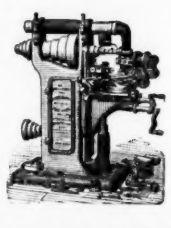

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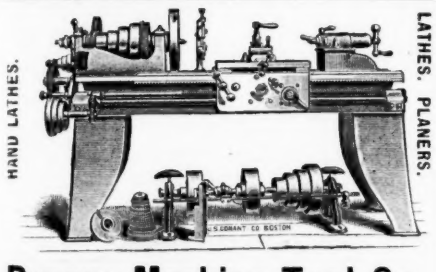

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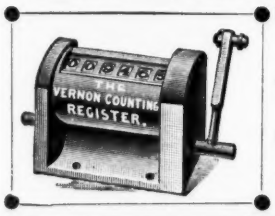

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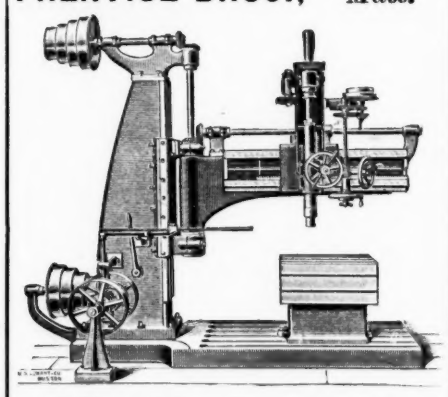

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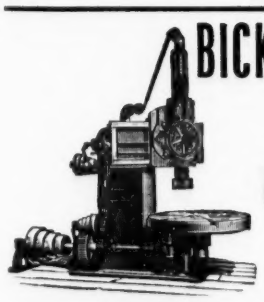

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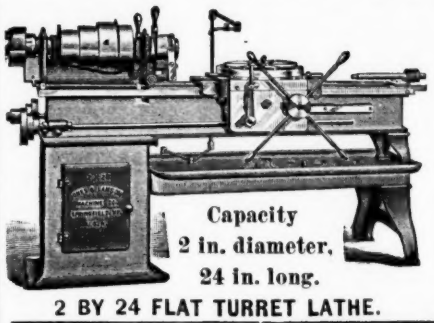

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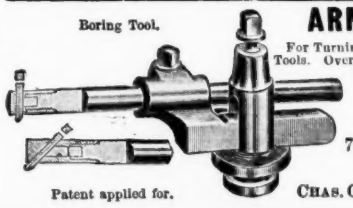

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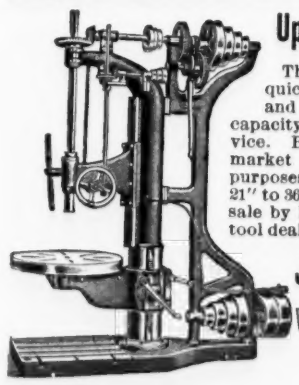

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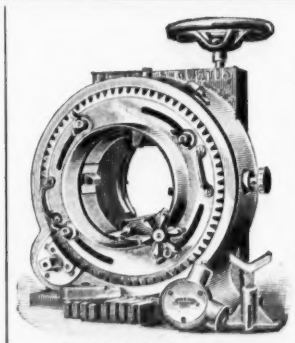

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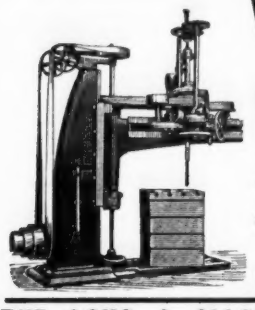

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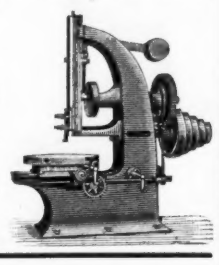

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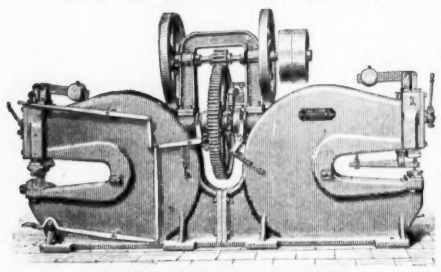

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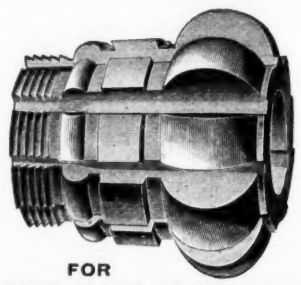

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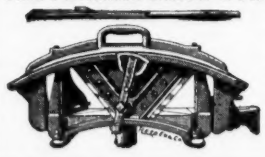

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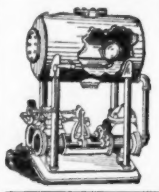

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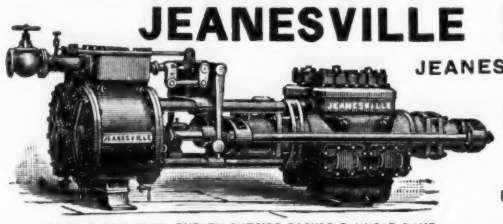

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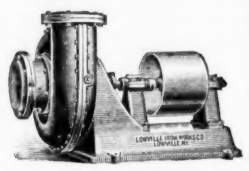

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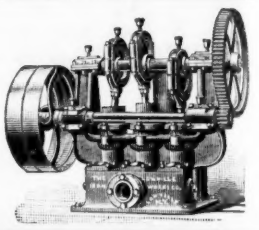

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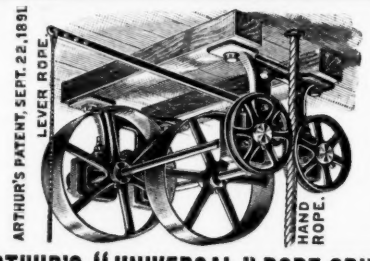

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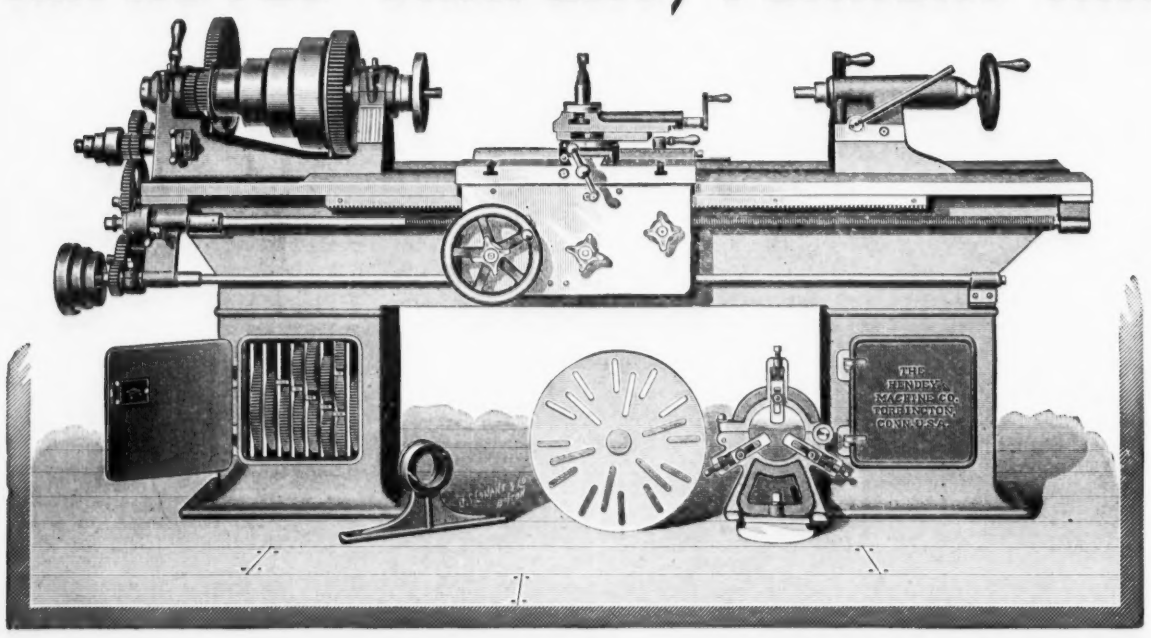

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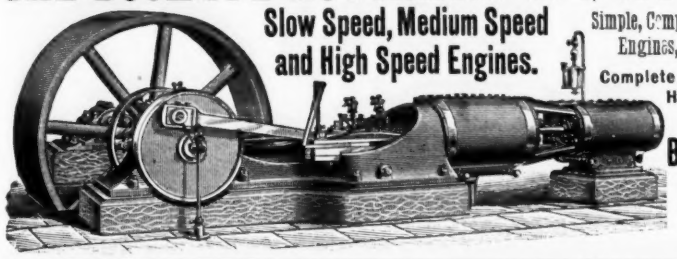

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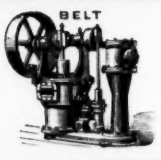

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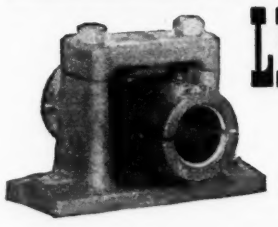

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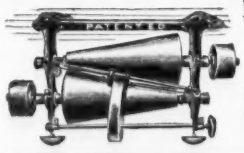

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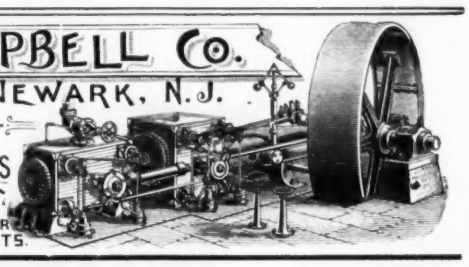

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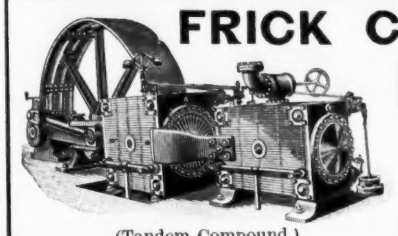

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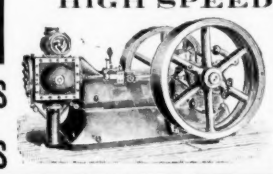

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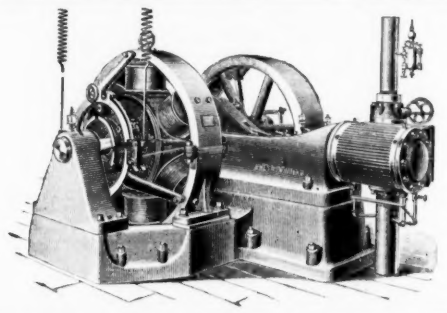

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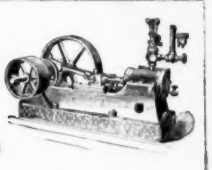

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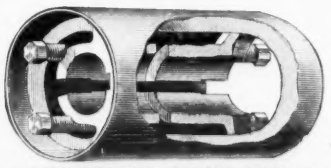

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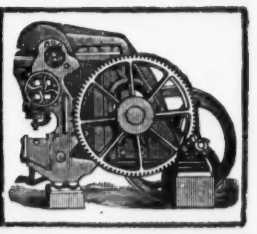

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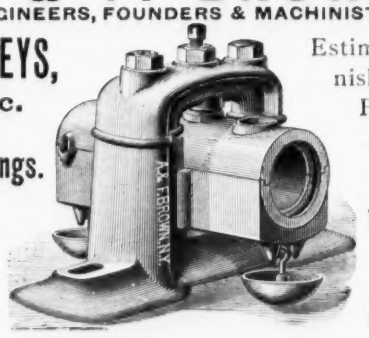

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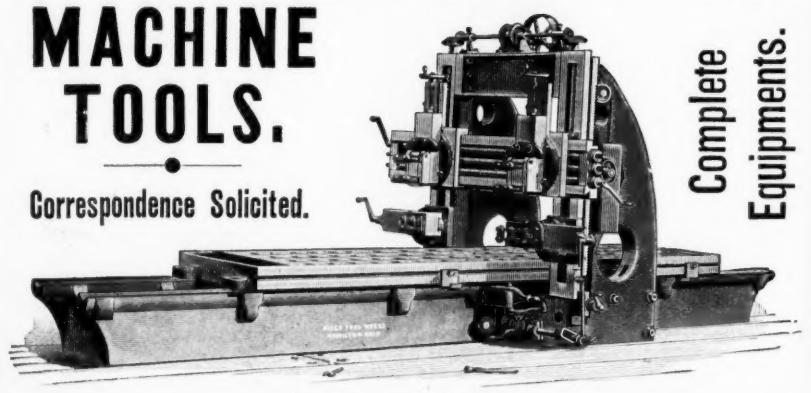

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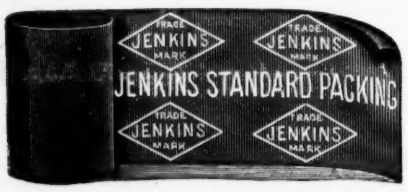

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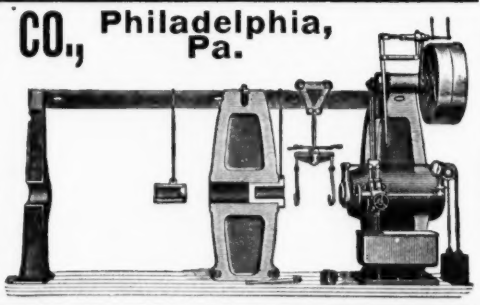

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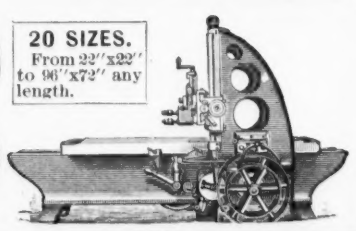

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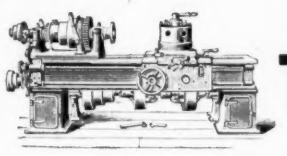

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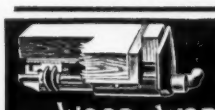

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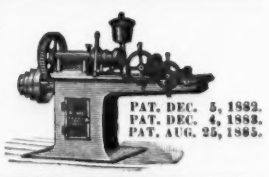

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